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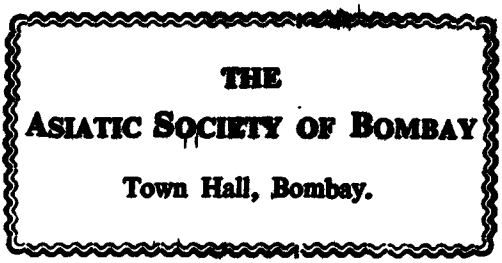

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CONTENTS

OF

THE SECOND VOLUME.

	Page
THYSANOPTERA	1
THRIPIDÆ	5
NEUROPTERA	5
TERMITIDÆ	11
PSOCIDÆ	17
PERLIDÆ	20
EPHEMERIDÆ	24
LIBELLULIDÆ	35
MYRMELEONIDÆ	41
HEMEROBIIDÆ	46
SIALIDÆ	49
PANORPIDÆ	52
RAPHIDIIDÆ	55
MANTISPIDÆ	58
TRICHOPTERA	60
PHRYGANEIDÆ	72
HYMENOPTERA	72
Terebrantia	88
Phytiphaga	89
TENTHREDINIDÆ	90
UROCERIDÆ	114
Entomophaga	122
CYNIPIDÆ	125
EVANIIDÆ	133
ICHNEUMONIDÆ	136
CHALCIDIDÆ	154
PROCTOTRUPIDÆ	167
CHRYSIDIDÆ	174
Aculeata	180
Prædones	184
Insectivora	185
CRABRONIDÆ	190
LARRIDÆ	200
BEMBECIDÆ	201
SPHEGIDÆ	203
SCOLIIDÆ	209
MUTILLIDÆ	213
Sodales (Philopona *K.*)	217
FORMICIDÆ	217
Diplopteryga	236
EUMENIDÆ	239
VESPIDÆ	244
Mellifera	252
ANDRENIDÆ	263
APIDÆ	267
Social Bees	278
STREPSIPTERA	287
STYLOPIDÆ	306
LEPIDOPTERA	306
Classification of Order	324
Rhopalocera	330
PAPILIONIDÆ	347
HELICONIIDÆ	351
NYMPHALIDÆ	353
ERYCINIDÆ	357
LYCÆNIDÆ	358
HESPERIIDÆ	360
Heterocera	361
SPHINGIDÆ	364
URANIIDÆ	369
ANTHROCERIDÆ	371
ÆGERIIDÆ	373
HEPIALIDÆ	375
BOMBYCIDÆ	379
ARCTIIDÆ	384
LITHOSIIDÆ	390
NOCTUIDÆ	391
GEOMETRIDÆ	395

	Page
Pyralidæ	398
Tortricidæ	401
Yponomeutidæ	404
Tineidæ	409
Alucitidæ	413
HOMOPTERA	414
Trimera	419
Cicadidæ	420
Fulgoridæ	427
Cercopidæ	431
Dimera	434
Psyllidæ	435
Aphidæ	437
Aleyrodidæ	442
Monomera	444
Coccidæ	444
HETEROPTERA	450
Hydrocorisa	457
Notonectidæ	458
Nepidæ	459
Aurocorisa	462
Galgulidæ	463
Acanthiidæ	465
Hydrometridæ	467
Reduviidæ	470
Cimicidæ	474
Tingidæ	477
Capsidæ	479
Lygæidæ	480
Coreidæ	482
Scutelleridæ	485
APHANIPTERA	489
Pulicidæ	489
DIPTERA	495
Nemocera	506
Culicidæ	507
Tipulidæ	513
Brachocera	529
Stratiomidæ	531
Beridæ	533
Cœnomyidæ	535
Tabanidæ	538
Bombyliidæ	542
Anthracidæ	543
Acroceridæ	545
Empidæ	546
Tachydromiidæ	547
Hybotidæ	548
Asilidæ	548
Mydasidæ	549
Therevidæ	550
Leptidæ	551
Dolichopidæ	552
Scenopinidæ	553
Syrphidæ	556
Conopsidæ	560
Muscidæ	561
Œstridæ	575
Pupipara	580
Hippoboscidæ	581
Nycteribiidæ	585

ALPHABETICAL INDEX

TO

THE FAMILIES.

Acanthiidæ, ii. 465.
Achetidæ, i. 439.
Acroceridæ, ii. 545.
Ægeriidæ, ii. 373.
Agathidiidæ, i. 130.
Aleyrodidæ, ii. 442.
Alucitidæ, ii. 413.
Andrenidæ, ii. 263.
Anoplognathidæ, i. 215.
Anthracidæ, ii. 543.
Anthroceridæ, ii. 371.
Aphidæ, ii. 437.
Aphodiidæ, i. 207.
Apidæ, ii. 267.
Arctiidæ, ii. 384.
Asilidæ, ii. 548.
Attelabidæ, i. 333.

Bembecidæ, ii. 201.
Beridæ, ii. 533.
Blapsidæ, i. 320.
Blattidæ, i. 414.
Bombycidæ, ii. 379.
Bombyliidæ, ii. 542.
Bostrichidæ, i. 277.
Bruchidæ, i. 326.
Buprestidæ, i. 226.
Byrrhidæ, i. 178.

Cænomyidæ, ii. 585.
Cantharidæ, i. 295.
Capsidæ, ii. 479.
Carabidæ, i. 57.
Cassididæ, i. 376.
Cebrionidæ, i. 243.
Cerambycidæ, i. 362.
Cercopidæ, ii. 431.
Cetoniidæ, i. 221.
Chalcididæ, ii. 154.
Chrysididæ, ii. 174.
Chrysomelidæ, i. 385.
Cicadidæ, ii. 420.
Cicindelidæ, i. 47.
Cimicidæ, ii. 474.
Cistelidæ, i. 309.
Cleridæ, i. 261.
Coccidæ, ii. 444.
Coccinellidæ, i. 395.
Conopsidæ, ii. 560.
Coreidæ, ii. 482.
Crabronidæ, ii. 190.
Crioceridæ, i. 372.
Culicidæ, ii. 507.
Curculionidæ, i. 338.
Cynipidæ, ii. 125.
Cyphonidæ, i. 246.

Dermestidæ, i. 155.
Diaperidæ, i. 314.
Dolichopidæ, ii. 552.
Dynastidæ, i. 210.
Dyticidæ, i. 95.

Elateridæ, i. 235.
Empidæ, ii. 546.
Endomychidæ, i. 393.
Engidæ, i. 143.
Ephemeridæ, ii. 24.
Erotylidæ, i. 391.
Eryeinidæ, ii. 357.
Eucnemidæ, i. 232.
Eumenidæ, ii. 239.
Evaniidæ, ii. 133.

Forficulidæ, i. 398.
Formicidæ, ii. 217.
Fulgoridæ, ii. 427.

Galerucidæ, i. 381.
Galgulidæ, ii. 463.
Geometridæ, ii. 395.
Geotrupidæ, i. 201.
Glaphyridæ, i. 220.
Gryllidæ, i. 450.
Gyrinidæ, i. 105.

Heliconiidæ, ii. 351.
Helophoridæ, i. 120.
Helopidæ, i. 311.
Hemerobiidæ, ii. 46.
Hepialidæ, ii. 375.
Hesperiidæ, ii. 360.
Heteroceridæ, i. 113.
Hippoboscidæ, ii. 581.
Histeridæ, i. 181.
Horiidæ, i. 291.
Hybotidæ, ii. 548.
Hydrometridæ, ii. 467.
Hydrophilidæ, i. 122.

Ichneumonidæ, ii. 136.

Lagriidæ, i. 289.
Lampyridæ, i. 246.
Larridæ, ii. 200.
Leptidæ, ii. 551.
Lepturidæ, i. 369.
Libellulidæ, ii. 35.
Lithosiidæ, ii. 390.
Locustidæ, i. 456.
Lucanidæ, i. 185.
Lycænidæ, ii. 358.
Lygæidæ, ii. 480.
Lymexylonidæ, i. 273.

Mantidæ, i. 424.
Mantispidæ, ii. 58.
Melandryidæ, i. 305.
Melolonthidæ, i. 216.
Melyridæ, i. 258.
Mordellidæ, i. 292.
Muscidæ, ii. 561.
Mutillidæ, ii. 213.
Mycetophagidæ, i. 152.
Mydasidæ, ii. 549.
Myrmeleonidæ, ii. 41.

Nepidæ, ii. 459.
Nitidulidæ, i. 140.
Noctuidæ, ii. 391.
Notonectidæ, ii. 458.
Notoxidæ, i. 286.
Nycteribiidæ, ii. 585.

Nymphalidæ, ii. 353.

Œdemeridæ, i. 304.
Œstridæ, ii. 575.

Panorpidæ, ii. 52.
Papilionidæ, ii. 347.
Parnidæ, i. 115.
Paussidæ, i. 150.
Perlidæ, ii. 20.
Phasmidæ, i. 430.
Phryganeidæ, ii. 60.
Pimeliidæ, i. 323.
Prionidæ, i. 359.
Proctotrupidæ, ii. 167.
Psocidæ, ii. 17.
Psyllidæ, ii. 435.
Ptinidæ, i. 268.
Pulicidæ, ii. 489.
Pyralidæ, ii. 398.
Pyrochroidæ, i. 287.

Raphidiidæ, ii. 55.
Reduviidæ, ii. 470.
Rutelidæ, i. 213.

Salpingidæ, i. 304.
Scaphidiidæ, i. 134.
Scarabæidæ, i. 203.
Scenopinidæ, ii. 553.
Scoliidæ, ii. 209.
Scolytidæ, i. 350.
Scutelleridæ, ii. 485.
Scydmænidæ, i. 279.
Sialidæ, ii. 49.
Silphidæ, i. 135.
Sphæridiidæ, i. 128.
Sphegidæ, ii. 203.
Sphingidæ, ii. 364.
Staphylinidæ, i. 162.
Stratiomidæ, ii. 531.
Stylopidæ, ii. 306.
Syrphidæ, ii. 556.

Tabanidæ, ii. 538.
Tachydromiidæ, ii. 547.
Telephoridæ, i. 255.
Tenebrionidæ, i. 316.
Tenthredinidæ, ii. 90.
Termitidæ, ii. 11.
Therevidæ, ii. 550.
Thripidæ, ii. 1.
Tineidæ, ii. 409.
Tingidæ, ii. 477.
Tipulidæ, ii. 513.
Tortricidæ, ii. 401.
Trogidæ, i. 208.

Uraniidæ, ii. 369.
Uroceridæ, ii. 114.

Vespidæ, ii. 244.

Yponomeutidæ, ii. 404.

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ERRATA ET ADDENDA.

VOL. I.

Page 1. line 13. for "regarded Mr. MacLeay" read "regarded by Mr. MacLeay."

10. line 1. dele "upper lip."

21. note *, The name Dermaptera was first used by De Geer himself for the mandibulated Hemiptera, which Olivier subsequently, named Orthoptera. Leach improperly retained the latter name, and separated the Forficulidæ therefrom, for which with equal impropriety, he retained the name of Dermaptera. Retzius, in his commentary on De Geer, confused these names, by giving the mandibulated Hemiptera under the name of Hemiptera, and a portion of the haustellated ones (Cimex, &c.) under that of Dermaptera. The latter name ought certainly to supersede Olivier's name, Orthoptera.

31. line 1. add: *Hope.* The Coleopterist's Manual. Parts 1, 2, 3. London, 8vo. 1837—1840.

line 10. add: *Stephens.* Manual of British Coleoptera. London, 1 vol. 8vo. 1839.

Spry and Shuckard. British Coleoptera delineated: in parts, 8vo. 1839—.

Shuckard. Elements of British Entomology. Part 1., 1839.

47. Messrs. Kirby and Spence, in a subsequent edition of their *Introduction*, give the name Eutrechina instead of Eupodina.

86. See *Entomol. Mag.* vol. i. p. 92. for an account of the habits of Broscus.

95. line 9. for "*Zool. Journ.*" read "*Zool. Misc.*"

114. line 24. for "Helerocerus" read "Heterocerus."

151. line 12. Mr. Miers has communicated to me a species of Cerapterus, captured in the neighbourhood of Rio Janeiro, forming a distinct subgenus.

162. note *, add: *Erichson.* Genera et Species Staphylinorum. 8vo. 1839.

192. note *, add: *Schmidt's* Review of German Aphodii in Germar's Zeitschr. f. d. Entomol. No. 3.

196. M. V. Audouin has communicated to me an instance of the destruction of the larvæ of Melolontha vulgaris by Gordii.

235. note *, add: *Germar.* Distribution of Elateridæ, in his Zeitschr. f. d. Entomol. No. 2.

332. line 35. for "exo" read "exotic."

333. line 18. for "*fig.* 40. 22." read "40. 23."

336. line 5. M. Huber has published an extended memoir on the habits of Attelabus in the *Memoirs of the Academy of Geneva*, vol. viii. part 2.

346. line 28. for "this disease" read "curing this disease."

Page 407. Since the publication of the sheets relative to the Orthoptera, two works especially devoted to that order have been published; namely, the second part of the second volume of Burmeister's *Handbuch der Entomologie*, 1838, and *Histoire Naturelle des Insectes Orthoptères*, 1839, by M. Serville. In these works numerous new genera are proposed, chiefly founded upon exotic species, under distinct names. Burmeister has subsequently reviewed their synonymy in the third part of Germar's *Zeitschrift fur d. Entomologie.*

428. note *, line 2. for " Blattidæ " read " Mantidæ."

451. *fig. 55.* 16. The short transverse lines at the tips of the antennæ indicate the extremities of these organs to have been cut off.

VOL. II.

Page 5. add as note: * Bibliogr. Refer. to the Neuroptera.

Say, in Goodman's Western Quarterly Reporter, vol. 2. 8vo. 1823. (13 sp. Neuropt. collected in the Expedition to the Rocky Mountains.) — Ditto, Descriptions of new North American Neuroptera (not yet published. See his Life).

Burmeister. Hand. d. Entomologie, vol. ii. part 2. p. 2. (Neuroptera) 1839.

Stephens, Curtis, Latreille, &c.

15. M. Lacordaire has published some original observations on the different kinds of individuals composing the species of Termitidæ in his *Introduction to the Natural History of Insects.*

17. line 18. I have recently discovered an apterous species of this family, possessing more than twenty-five joints in the antennæ, and 3-jointed tarsi.

25. note *, The existence of the anomalous character of an additional pair of eyes, placed on pillars, is not confined to the males of a single species, or even subgenus of Ephemeridæ. I have this day (May 14. 1840) taken both sexes of the two-winged species, figured by Mr. Stephens under the name of Cloeon dipterum, and find that the males possess this character, and are, in colour, quite unlike the females. Neither Leach nor Stephens have noticed the sexual characters of Cloeon. The species figured by Réaumur, possessing two similar additional pedunculated eyes (tom. iv. pl. 19. fig. 3.), evidently belongs, from his accurate description of the very minute hind wings, to my subgenus Brachyphlebia. Burmeister (*Handb.* vol. ii. p. 798.) gives E. bioculata *L.*, as the male of E. diptera *L.*

45. Mr. Swainson has published a figure of the larva of Ascalaphus MacLeayanus *Guild.* in his volume on the *Habits and Instincts of Animals*, p. 29. It differs from my *fig.* 63. 20. and *from Guilding's description*, in having only nine filamentous processes on each side.

51. Dr. Buckland has described a remarkable fossil insect, of which

a wing only has been discovered, under the name of Hemerobioides giganteus (*Proceed. Geol. Soc.* June 6. 1838); it having appeared to me to possess greater affinities with the wing of Hemerobius than any other existing insects.

Page 72. line 35. for "apud" read "Apum."

74. line 4. Say (*Boston Journ. of Nat. Hist.* vol. i. no. 4.) describes a section of Lyrops with only one ocellus.

76. note *, The Baron de Romand has had the kindness to send me a copy of a memoir on the variations in the nervures of the Hymenopterous wings, recently published by him privately, and illustrated by numerous figures.

82. line 10. and 22. for "cuckoo flies" read "ichneumon flies."

84. *et passim*, for "Bethyllus" read "Bethylus."

88. The valuable classification of the Hymenoptera, published by Mr. Haliday, reached me too late to be noticed in the text. It is partially noticed in the Generic Synopsis.

114. line 18. for "Siricidæ" read "Uroceridæ."

119. and 121. Saint Fargeau, in his *Hist. Nat. Hymenopt.* p. 5. notes 1, 2, and 3., has re-stated his opinion of the parasitic nature of Urocerus and Xiphydria. The German entomologists, who have such ample opportunities for studying the habits of these insects, describe them as Xylophagous, and the structure of their jaws confirms such statement.

123. line 13. for "top" read "tip."

line 33. I have used the name of Entomophaga instead of Latreille's Pupivora, which is inapplicable to the majority of the species.

125. note *, add: *Hartig.* Revision of the fam. Cynipidæ (divided into twenty-one Genera) in Germar's Zeitschrift, f. d. Entomol. No. 3.

127. line 20. for "73. c." read "73. 22. c."

143. line 8. M. Wesmael (*Ann. Soc. Ent. de France*, 1837, pt. 3.) describes the habits of a Bracon, which attacks Scolytus. I took one of the species of this genus in the Parc de Belle Vue, near Paris, on felled trees infested by Scolyti, and which M. Audouin also informed me was its parasite.

145. line 25. Moses Harris states that "on a moderate computation," there might be 20,000 minute Ichneumons found by him in a single chrysalis of a goat moth (Aurelian, pl. 23.).

146. line 23. *bis*, for "its" read "their."

M. Schiodte has figured some Ichneumonidæ in Guérin's *Magazin de Zoologie*, which exhibit similar peculiarities in the mode of exclusion of the eggs.

148. line 36. for "both at the top and bottom" read "either at the top or bottom."

164. line 34. My monograph on Leucospis has been published in the second part of Germar's *Zeitschrift, f. d. Entomologie.*

169. Mr. Curtis, in his dissections of the ovipositor of Proctotrupes, noticed, in addition to the parts figured by me (*fig.* 78. *7*), an elongated membranous plate. I had also noticed this in several of the females of this genus which I had dissected, but

concluded it was some extraneous matter or the lining of the other parts.

Page 171. line 17. for " an inch " read " a line."

173. line 17. for " Diapria," read " Diapria),".

174. note *, add: *Klug*, in Proceed. Roy. Acad. Berlin, 10 Jan., 1839 (and in Annals of Natural History).

184. line 24. after Sodales add (Philopona *Kirby, F. B. Amer.*)
line 26. after Diploptera add (Diplopteryga *K., F. B. Amer.*)

207. line 9. and following. S. S. Saunders, Esq. has transmitted to his cousin W. W. Saunders, Esq., from Albania, the mud nests made by Pelopæus spirifex; and Mr. Doubleday mentions that the American species of that genus are well known in the United States under the name of " mud dabs," from their nests resembling a patch of mud.

212. line 34. *fig.* 84. 11. represents the labium of Sapyga punctata.

216. line 1. Mr. Shuckard has published (*Annals of Nat. Hist.* May, 1840) the commencement of a monograph on the family (as he terms it) Dorylidæ, in which he describes two new genera and numerous species; and has endeavoured to prove, 1. that these insects are more nearly allied to the Mutillidæ, and are consequently not furnished with neuters; 2. that they are parasites; and 3. that my genus Typhlopone (*fig.* 86. 17—20.) is the female of the genus Labidus. I propose to make some remarks on this memoir, not coinciding with several of these opinions.

233. line 31. Mr. Swainson, unacquainted with these observations, has published an account of the habits of a Brazilian species of Amazon ant, which makes slaves of the neuters of other species, but which it carries off in the perfect neuter state, and not whilst larvæ or pupæ. (*On the Habits and Instincts of Animals*, p. 334.)

234. line 9. Mr. Swainson, in like manner, unacquainted with these observations, has detailed, as a new fact, the circumstance of the ants of Brazil milking the Membracides of that region in consequence of the absence of the Aphides. (*Habits of Animals*, p. 338.)

241. line 24. and 240. note *. M. Dufour's memoir has been published in the *Annales des Sci. Nat.* for Jan. 1839, accompanied by supplemental observations by M. Audouin. In these memoirs four distinct species are stated to form curved tubes at the mouths of their burrows in the sand. M. Audouin (like Mr. Shuckard), following M. Wesmael, considers the O. muraria, whose history is detailed by Réaumur (Mém. 6. pl. 26. f. 2.), as identical with Oplomerus spinipes. The O. rubicola *L. D.* is closely allied to the O. lævipes of Shk.

253. note *, add: *Herrich Schaffer* on the European Nomadæ in Germar's Zeitschr. f. d. Entomol. tom. ii. pt. 1.

Jardine's Naturalist's Library, Volume on Bees, containing figures and descriptions of some new exotic species by myself.

Page 257. note *, line 4. for "*fig.* 89. 19." read "89. 9."

347. line 12. for "Heterocera" read "Rhopalocera."

line 20. for "Thysanumorpha" read "Thysanuromorpha."

368. line 8. See also Nordmann, in *Rev. Zool. Soc. Cuvierr.* Aug. 1838.

437. line 10. Mr. Hoy has given (*Linn. Trans.* vol. ii. p. 354.) an account of the production of Chermes graminis (which is evidently identical with Livia Juncorum) from Juncus articulatus β of Linnæus, by whom it was supposed to be a viviparous variety.

441. line 1. for "species agreeing" read "species nearly agreeing."

2. for "Lachnus lanigerus" read "Eriosoma lanigera."

4, 5. dele "which Mr. Haliday has conjectured is identical with Phylloxera."

445. line 2. for "Pseudoccus" read "Pseudococcus."

535. line 16. Mr. Gosse, in the *Canadian Naturalist*, London, 1840, p. 199., has described and figured the pupa and imago of an American species of Cœnomyia, which he had observed amongst the grass, extricating itself from the pupa, which "is large, and the hind segments have rings of spines; its colour is chestnut-brown, and it much resembles that of a large moth. I have no doubt it is subterraneous in the pupa state." I have followed Latreille, the founder of this genus, in writing the name Cœnomyia.

MODERN CLASSIFICATION

OF

INSECTS.

Order THYSANOPTERA *Haliday*.*

(Genus Thrips *Linn.*)

Char. Wings 4, alike, long, narrow, membranous, neither folded nor reticulated, with long ciliæ, laid horizontally along the back when at rest.

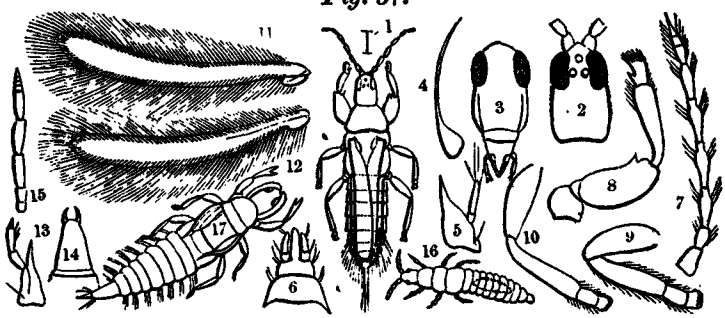
Mouth with two setiform mandibles; two triangular flat palpigerous (but not galeated) maxillæ, and a palpigerous labium.

Tarsi, with two joints, vesiculose at the tip.

Pupa active, semi-complete.

The insects of this order (*fig.* 57. 1. Phlæothrips coriacea *Hal.*?)

Fig. 57.



are of a very minute size, rarely exceeding a line in length; the body is long, linear, and depressed; the head (*fig.* 57. 2. upper side) is

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* Bibliogr. Refer. to the Thysanoptera. (Thripidæ.)

Haliday, in Entomol. Mag. vol. iii. and iv.

Schrank. Beitrage zur Naturgesch. 1776. Leipz.

Passerini, in Atti dell Acad. Georgofili. t. xii.

Vassali Eandi, in Mém. Acad. Turin, tom. xvi. p. 76.

Heeger. ——?

Linnæus, Fabricius, De Geer, Geoffroy, Latreille.

oblong, narrower than thorax, without any distinct neck; the eyes are large, coarsely granulated, and occupy its anterior lateral angles, besides which, there are ordinarily three ocelli between the eyes, and behind the antennæ; the underside of the head (*fig.* 57. 3.) is prolonged into a kind of conical beak, which extends beneath the prosternum; the antennæ (*fig.* 57. 7. and 57. 15. T. fasciata) are longer than the head, filiform, and apparently varying in the number of joints from five to nine, in consequence of the terminal joints being more or less firmly soldered together; they are inserted in front of the head. The parts of the mouth, although constructed in the mandibulated and palpigerous form, unite into a short conical sucker, which does not extend beyond the anterior coxæ. The clypeus and labrum occupy the anterior part, the latter being linear-subconical, beneath the base of which arise a pair of horny setiform mandibles (*fig.* 57. 4.), of which the base is dilated into a flattened plate in the species I have dissected. (Mr. Haliday described them as having a bulbous base, and, by their junction towards the tip, as forming a 2-valved syphon.) The maxillæ (*fig.* 57. 5. and 57. 13. T. fasciata) are flat, elongate-triangular, and pointed at the tip, without any apparent articulation, and with a 2 or 3-jointed palpus, arising on the outer edge near the middle; there is no appearance of an outer lobe or galea. The labium (*fig.* 57. 6.) is submembranaceous, and more or less attenuated in front; in some species the mentum is very distinct, and the labium is extended in front, between, and of equal length with, the palpi*; but in T. fasciata (*fig.* 57. 14.) I could not perceive it to be prolonged beyond the base of those organs; the labial palpi are very short, and 2 or 3-jointed.

De Geer was the first author who noticed the existence of palpi in these insects. Latreille, also, described the maxillary pair, but regarded the labial palpi as articulated laciniæ. He, moreover, overlooked the mandibles which were first observed by Strauss, who communicated the discovery to Latreille (*Fam. Nat.* p. 416.), who, however, seems to have been inclined to doubt their right to such a title, although admitting that, if they were really mandibles, they would form a very peculiar family in the order Orthoptera; although

* "Rostri vagina (including the maxillæ and labium), submembranacea ad basin lata et utrinque uni-palpigera (scil. the maxillary palpi), apice profunde trifida; laciniis æque longis, media acuta; externis (scil. the labial palpi), sublinearibus triarticulatis; palpi (maxillary), brevissimi filiformes," &c. *Latr. Gen.* 3. 171.

"l'ensemble de leur organisation" appeared more allied to the Homoptera than the Orthoptera.*

The figures given above are the first which have yet been published of the parts of the mouth in detail of these curious insects.

The prothorax is large, depressed, and more or less narrowed in front, its hind part being broader than the head; the meso- and metathorax are large, flat, and closely soldered together, the former being often the shorter, and transverse; the meso-scutellum is not a conspicuous piece; the four wings are nearly alike, the anterior pair (*fig.* 57. 11.) being rather larger than the posterior (*fig.* 57. 12.); they are ordinarily narrow, membranous, and without nerves, crossing and resting horizontally upon the back, and furnished with long and delicate ciliæ, extending all round the wings. In some species, however, Mr. Haliday describes the fore-wings as transformed into broadish elytra, ciliated only behind, and with longitudinal and transverse nerves. In some species the wings are wanting, at least in the males; the abdomen is terminated either by a long attenuated joint or by a 4-valved borer in the female; the legs are short, the anterior pair having the femora sometimes much incrassated, with a tooth near the inner extremity (*fig.* 57. 8.); the tibiæ are simple, the tarsi 2-jointed, terminated by a vesicle† without ungues; the base of the anterior tarsi is, in some species, armed with a tooth, at least in the males; the middle (*fig.* 57. 9.) and posterior pair of legs (*fig.* 57. 10.) are simple. My figures, 57. 1—12., are taken from the largest species of the order which I have seen, and of which I captured a considerable number, creeping under and upon the bark of felled trees, at Sèvres, in July, 1837. It appears to be nearly allied to Phlæothrips coriacea *Hal.*

The eggs of Phlæothrips statices *Hal.* "are shaped like those of Culex, being cylindric, rounded at one end, and crowned with a knob at the other." The larva (*fig.* 57. 16., from De Geer) is equally active with the imago inhabiting the same situations, and differing in smaller size, softer body, distinct thoracic segments; "the mouth is almost alike, the antennæ and legs shorter; there are no simple eyes, and the com-

* If regarded as Mandibulata (although they are certainly not Dacnostomatous), they will possess the greatest affinity with those Biomorphotic insects which have equal sized unfolded wings, and which will be found amongst the earlier families of Neuroptera, especially the Termitidæ.

† De Geer observes, that, when the animal presses this vesicle on the surface upon which it walks, its diameter is increased, and it sometimes appears concave, the concavity being in proportion to the pressure, which made him suspect that it acted like a cupping-glass.

pound eyes are replaced by conglomerate eyes; the pupa (*fig.* 57. 17., from De Geer) resembles the perfect insect, but the articulation of the limbs is obscured by a film, and the wings enclosed in short fixed sheaths. The antennæ are turned back on the head, and the insect, though it moves about, is much more sluggish than in the other states." (Haliday, *Ent. Mag.* 15. p. 440.) The larvæ are generally much paler coloured than the imago, being in some species blood red, whilst the imago is black; in others, pale yellow.

These insects are found upon various plants, sometimes swarming in immense profusion in various kinds of flowers, especially the large white hedge-convolvulus; they are very agile, and often leap to a considerable distance when disturbed. They feed upon the juices of plants, and are often extremely injurious, especially in hot-houses and vine-houses; the leaves upon which they reside being marked all over with small decayed patches. They also, especially, infest melons, cucumbers, kidney beans, &c. Various plans for their extirpation are given in the *Gardener's Magazine*, and in Major's work on the insects which infest fruit trees.

One species, to which Mr. Haliday has applied the specific name of Thrips cerealium, infests the wheat, sometimes to a mischievous extent. This species was observed by Mr. Kirby, between the internal valve of the corolla and the grain, and taking its station in the furrow of the seed, in the bottom of which it seems to fix its rostrum, and by depriving it of its moisture, occasions it to shrink up, and become what the farmers call pungled. One sex of this species is apterous; the larva is yellow and very nimble, and the pupa whitish, with black eyes, and very slow and sluggish. (*Linn. Trans.* vol. iii. p. 247.)

According to Vassalli Eandi (quoted by Mr. Haliday), this species also gnaws the stems above the knots, and causes the abortion of the ear. In the year 1805, one third of the wheat crop in Piedmont is said to have been destroyed by this minute insect; and in the same year the wheat crops in England suffered materially from a similar cause.

Another species is very injurious to the olive tree in the territory of Pietro Santa in Tuscany, fixing itself on the under side of the leaves. As early as the month of April, four or five eggs are deposited on each bud; and, as the generations of the insect succeed from spring to the end of autumn, the number of insects becomes inconceivable. (Passerini, "Alcune notizie sopra una specie d'Insetto

dannoso agli Olivi," &c. in *Atti dell' Accad. de Georgofili*, t. xii. and Guérin, *Bullet. Zool.* p. 12.)

In Hill's *Decade of Curious Insects*, 1773, an insect is described under the name of Alucita pallida (the straw-coloured Chinch), which is evidently a species of Thrips, of which great numbers are asserted to have been discharged by "a studious gentleman, very subject to the headach," whilst sneezing.

The relations of this order are very difficult: the nature of the metamorphoses would unite it with the Orthoptera or Hemiptera, whilst the structure of the wings and mouth remove it from both those orders; the mouth, indeed, seems to be of a character almost intermediate between the Mandibulata and the Haustellata; the setiform mandibles are very like those of the Hemiptera, whilst the general disposition of the other parts of the mouth are more like those of a real mandibulated insect. It appears doubtful to me, however, whether the action, even of the maxillæ, can be transverse, or whether the insect can be said to bite its food.

The order comprises but a single family, THRIPIDÆ *Leach*, the species of which are far more numerous than has been generally supposed, as may be learned from Mr. Haliday's valuable memoir, published in the *Entomological Magazine*, No. 15. I have also seen some plates containing magnified figures of various species of the family by M. Heeger; but I am not aware whether they are yet published.

ORDER NEUROPTERA *Linnæus*.

CHAR. Wings four, generally large, equal sized, membranaceous, with numerous areolets, posterior pair ordinarily not folded.

Mouth with transversely moveable jaws.

Abdomen of the females unarmed with a pungent multivalve ovipositor.

"Scapulæ and parapleuræ parallel and oblique." *Kirby*.

Pupa various, in some quiescent, with the limbs folded over the breast; in others active, and more or less resembling the perfect insect; larva with six articulated legs.

The insects of this order, established by Linnæus, differ from those of the preceding orders in the membranaceous structure of their four naked wings, which, together with the masticatory trophi, will sufficiently separate them from the whole of the haustellated division.

From the equally mandibulated Hymenoptera, they are removed by the equal size of their wings, by their non-possession of a pungent sting, or multivalve ovipositor, and by their maxillæ and labium not uniting to form a tubular apparatus. From the Trichoptera, which are still associated with them by the continental entomologists, they are separated by the collar-like neck, pilose, branching-nerved wings, elongated coxæ, and obsolete trophi, which characterise the latter named order.

This order comprises several well-known families of insects, namely, the beautiful dragon flies, the May flies, lace-winged flies, white ants, and ant-lion flies; and derives its name from the Greek, *νευρον*, a nerve, and *πτερον*, a wing; in allusion to the beautiful net-work with which their wings are ornamented, forming a very numerous series of cells or areolets, far exceeding in number the cells in the wings of any other insect. The order is one of comparatively small extent, being far inferior in point of number of species to many of the other orders; but the characters, which distinguish even the few families of which it is composed, are far more discordant than those of any of the rest, there being scarcely a leading characteristic of the order which does not meet with an exception; thus, in some genera, the posterior wings are either larger or smaller than the anterior, sometimes, as in certain genera, as Cloeon, they entirely disappear; in others, as the female Boreus, and one of the species of Atropos, the wings are entirely obsolete; again, in the male Boreus, they are not membranaceous but leathery. The structure of the mouth is very varied; in Libellula it assumes an anomalous appearance; and in Ephemera the jaws are entirely obsolete. The transformations are also equally varied; indeed, Mr. MacLeay states that the essential character of the order is varied, the larvæ undergoing either an incomplete (Corydalina), obtect (Myrmeleonina), subsemicomplete (Libellulina), or semicomplete metamorphosis (Termitina). Myrmeleon, however, most certainly has an incomplete pupa; whilst the transformations of the Libellulidæ and Ephemeridæ, which (according to Latreille, as quoted by MacLeay), compose the stirps Libellulina, although peculiar and very unlike each other, appear to me to enter into the semicomplete species of transformation. It is to be regretted that Mr. MacLeay has given no definition of the term subsemicomplete, which he proposed for this stirps. As to the transformations of the Panorpidæ, it will be seen, from my account of that family, that the theories which Mr. MacLeay entertained respecting it (*Horæ Ent.* p. 433.) are completely fallacious.

The body is generally long and slender, of a soft, or but slightly scaly consistence; the head is not generally immersed in the prothoracic cavity, the prothorax being mostly collar-shaped, and forming with the other thoracic segments a portion of the body, well distinguished from the abdomen, which is, however, ordinarily sessile; the ocelli, two or three in number, are generally present.

There is also a great dissimilarity in the habits and economy of these insects, although the majority are predaceous. In their larva state their abodes are very diversified, some larvæ residing in the water, others in damp earth, others living exposed upon plants, others again concealing themselves under a cloak of excrement, or in a pitfull of fine sand, whilst a few reside in colonies of immense extent. These insects are of an intermediate size, none exceeding our largest dragon flies in size, and none equalling in minuteness the minims of the Hymenoptera or Coleoptera.

Various insects of this order have afforded to Carus, Bowerbank, Tyrrell, and others, materials for the discovery and observation of the circulation of the blood in insects.

Linnæus, whose character of the order was simply "Alæ 4, nudæ, venis reticulatæ: cauda sæpius aliquo sexus adminiculo instructa, inermis" (*Syst. Nat.* t. ii. p. 901.), introduced into it the following genera, Libellula, Ephemera, Phryganea (or the caddice flies), Hemerobius, Myrmeleon, Panorpa, and Raphidia; the winged individuals of the genus Termes being introduced into the genus Hemerobius, whilst the apterous individuals were placed amongst the apterous insects. Fabricius remedied this error by taking in Termes amongst the other Neuroptera; which name, however, he altered to Synistata, but added thereto the spring-tailed insects (Thysanura *Latr.*). He also raised the genus Libellula into a distinct order (or class), Odonata.

Latreille adopted the order as left by Linnæus, with the addition of Termes; but Mr. Kirby separated Phryganea from the Neuroptera, and formed it into a distinct order under the name Trichoptera, in which he has been followed by English entomologists. MacLeay, however, further united the Perlidæ with the Trichoptera, in consequence of having evidently misunderstood Latreille's sections given in the *Genera Crust. et Ins.* t. iii. p. 209. and 212.*, and dividing Latreille's

* Mr. MacLeay says that the Perlariæ of Latreille's *Gen. Crust.*, &c., or the Phryganeidæ of Lamarck, is evidently a natural group, whose larvæ (admirably described by Aristotle under the name of Xylopthori) are aquatic, and live in tubes or sheaths made by themselves; and he then insists that the larvæ, metamorphoses,

little group Megaloptères into two, keeping Corydalis (Corydalina *MacLeay*) in the order Neuroptera, and giving Megaloptera *Latreille*, as a distinct and osculant group between that order and the Trichoptera: Boreus being also removed from the Neuroptera, and forming a distinct osculant group between it and the Orthoptera. It is scarcely possible to conceive a more unnatural mode of treating this order. More recently M. Brullé, in his Entomology of the Morea, has endeavoured to construct another distribution of these insects, which he divides into four orders, namely: —

1st, The Dictyoptera*, comprising Libellula, Ephemera, and Perla.

2nd, The Isoptera, consisting of the single genus Termes.

3rd, The Trichoptera, consisting of the single genus Phryganea.

4th, The Neuroptera, containing the remainder of the Linnæan genera. The genera Raphidia, Mantispa, and Psocus being removed to the order Orthoptera.

In rejecting these views, both of Brullé and MacLeay, I am influenced by the evident diversity which exists amongst these insects, whereby groups, most nearly related to each other, would be removed far apart were we to adopt them; thus ex. gr. Perla is clearly more nearly related to some of the genera left by Brullé in his restricted order Neuroptera than it is to Ephemera. It is for the same reason that I am not fully convinced of the propriety of keeping Phryganea as a distinct order, although I have thought it better to follow the steps of Kirby, Stephens, and MacLeay, respecting its separation, rather than unite it with the rest of the Neuroptera into one order as Latreille and Pictet have done.

Regarding then the Neuroptera as an order distinct from the Trichoptera, which is to be restricted to Phryganea, we find it related of course, on the one hand, to the Trichoptera, whilst, on the other, it closely approximates to the Orthoptera. The curious genus Mantispa,

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antennæ, mouths, and wings of Perla and Phryganea, all manifest their close affinity. (*Horæ Ent.* p. 430.) Now Latreille has nowhere given Phryganea as portion of the Perlariæ, as Mr. MacLeay clearly thought he had done; for had he studied the tabular distribution given in a preceding page of the "Genera," he would have seen that Latreille had not the slightest idea of uniting the Perlidæ and Phryganeidæ into one group; whilst, had he known the larva and metamorphoses of Perla, he would have found that they were as unlike those of Phryganea, as are the mouths and wings of the two genera.

* Leach had previously used this name for the genus Blatta; its application, therefore, to other insects was not warranted.

alternately placed by Latreille amongst the Orthoptera and Neuroptera, has been supposed by MacLeay to constitute a passage between the two orders; but from what I have already advanced concerning it (Vol. I. p. 412. note †), I am but little inclined to adopt this relation beyond one of analogy; if, indeed, the pupa of Mantispa were ascertained to be active and semicomplete, there might be better grounds for this relation. In like manner Mr. MacLeay has considered the Panorpideous genus Boreus as a connecting link between the two orders; influenced, indeed, not by the real characters of the insect, but apparently by Panzer having called it a Gryllus, and by the insufficient observation of early authors. There exist, however, nearer points of relation between the two orders than those pointed out by MacLeay; thus the genus Termes, in the structure of the mouth, and especially the galeated maxillæ and labium, is almost identical with the Orthoptera. The same may also be said of the Perlidæ, which have also the posterior wings longitudinally folded, and the extremity of the body terminated by articulated filaments; their pupa state is also active, and the larva resembles the imago.

Various plans have been suggested for the classification of this order. Latreille, in his various works, has adopted an arrangement founded upon the natural habits of these insects, commencing with those "vivant de rapine," at the head of which the Libellulæ are pre-eminent, followed by Ephemera, which, although destitute of organs of nutrition in the perfect state, is predaceous whilst a larva, and is closely allied to Agrion in the antennæ, form of head, size of eyes, &c. These are followed by other predaceous tribes, which are succeeded by the omnivorous white ants, and this series is closely followed by the Phryganeæ. The peculiarities of these insects in the preparatory states "consolident l'établissement et la suite des familles qui remplissent cet ordre." (Latr. *Cons. Gen.* p. 73.) In the *Règne Animal* (vol. v. p. 234.) we, however, find a more precise sketch of this proposed arrangement: —

1. Insectes carnassiers, demi-métamorphose, larves aquatiques.

2. Insectes carnassiers, métamorphose complète, larves terrestres ou aquatiques.

3. Insectes carnassiers, ou omnivores, terrestres, demi-métamorphose.

[4. Insectes herbivores, métamorphose complète, larves aquatiques, se construisant des domiciles portatifs." Phryganea.]

In the genera Crustaceorum, the arrangement of the families of

which the order is composed, founded upon these considerations, was as follows: —

Tribe 1. Subulicornes (having very short subulate antennæ), composed of (*a*) the mandibulated Libellulæ; and (*b*) the emandibulated Ephemeræ.

Tribe 2. Filicornes (having long, multi-articulate antennæ), composed of (*a*) the following mandibulated types, Panorpa, Myrmeleon, Hemerobius, Sialis, Corydalis (all with 5-jointed tarsi), Termes and Raphidia (with 4-jointed tarsi), Psocus (with 2 or 3-jointed tarsi), and Perla (with 3-jointed tarsi), and of (*b*) the single emandibulated genus Phryganea.

In the *Règne Animal* the same arrangement of the families is preserved; but they are divided into three primary tribes: — 1. Subulicornes (as above); 2. Planipennes; and, 3. Plicipennes, the second of which comprises all the mandibulated filicorn species; and the Plicipennes, the emandibulated Phryganea; the Planipennes being composed of the five following, families, Panorpates, Myrmeleonides, Hemerobines, Termitines, and Perlides.

To this arrangement M. Pictet and Mr. Newman (who have both particularly studied this order of insects) object, on the ground that the section Planipennes is of too heterogeneous a nature; and the former author (*Mem. Sialis*) accordingly proposes the adoption of six families in the order (including the Phryganea), namely: 1. Subulicornes *Latr.*; 2. Planipennes (Hemerobius and Myrmeleon); 3. Panorpates; 4. Termitines; 5. Perlides; 6. Phryganides. If we thus, however, separate the Latreillian Planipennes into four groups, it appears to me to be equally necessary to raise the two divisions of the Subulicornes to a like rank, which indeed Mr. Newman has done (*Ent. Mag.* No. 18/p. 237.); but it does not appear to me that a sufficient equality has been maintained in the construction of the natural families.

Taking the transformations as the ground of the distribution of the order, it appears to me to form two primary divisions: —

1. Those with an active pupa, undergoing a metamorphosis which, for want of a better name, we may, with MacLeay, term subsemicomplete; in all which there is a greater dissimilarity between the larva and imago states than exists in the insects typical of the monomorphous, semicomplete metamorphosis (Gryllus, &c.) Here belong the Psocidæ and Termitidæ, which have terrestrial larvæ, and the Libellulidæ

Ephemeridæ, and Perlidæ, which are aquatic in their preparatory states. I term the species of this division Biomorphotic insects.

2. Those which have quiescent incomplete pupæ, which, however, acquire the power of locomotion shortly before the assumption of the perfect state. This division (Subnecromorphotica) comprises the families Myrmeleonidæ, Hemerobiidæ, Sialidæ, Panorpidæ, Raphidiidæ and Mantispidæ.* Other arrangements might be adopted by considering other characters as of primary importance. The succession of the families proposed by Pictet appears the most natural of any hitherto published. The families, 1. Termitidæ; 2. Psocidæ; and, 3. Perlidæ, have the greatest relation to the Orthoptera; to these succeed the 4th family Ephemeridæ, and the 5th Libellulidæ; the 6th family Myrmeleonidæ, in the general form of the body and wings, appears to be the nearest to the Libellulidæ; to these succeed, 7th, the Hemerobiidæ; 8th, the Sialidæ; 9th, the Panorpidæ; 10th, the Raphidiidæ; and, 11th, the Mantispidæ, which last also manifest a near relation to the Orthoptera.

The family TERMITIDÆ† is composed of the various species of exotic insects, known under the name of white ants, placed by Linnæus in the order Aptera, on account of the apterous condition of

* This arrangement nearly corresponds with that suggested by Latreille in his *Hist. Nat. Gen. Ins.* tom. xiii. p. 100., as more natural than that adopted in the body of his work.

† BIBLIOGR. REFER. TO THE TERMITIDÆ.

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Koenig. Naturg. weis. Ameis. in ditto, b. iv. 1775.

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Besch. der Berl. Nat. Gesellsch. 1 band (on the Queen of the White Ants).

Kollar. Brasiliens Vorzuglich lastige Insecten. Wien. 1832. — Ditto, in Isis of Oken, 1833. (T. flavipes).

De Geer. Mémoires, vols. iii. and vii.

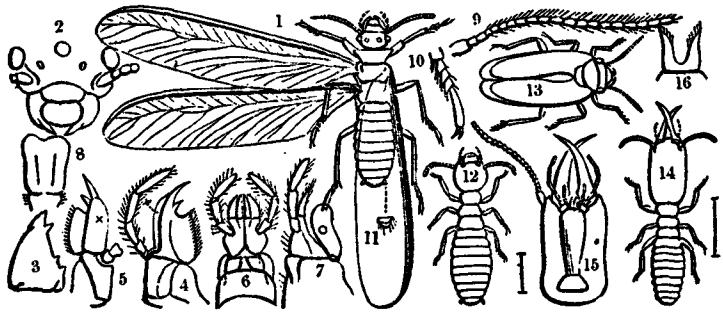
Perty. Delect. An. art. Brasiliæ.

some of the individuals, whilst he regarded the winged ones as belonging to the neuropterous genus Hemerobius.

M. Brullé proposes to form these insects into a distinct order in his work on the insects of the Morea, named Isoptera; whilst Mr. Kirby regards them as forming, together with the ants, to which they are allied in so many points in their economy, a passage between the orders Neuroptera and Hymenoptera.

These insects live in communities of countless numbers, of which the majority are apterous. The males and females are, however, winged, and are distinguished from the other Neuroptera by the following characters. The body is oblong, depressed, and of nearly equal breadth throughout (*fig.* 58. 1. represents a large Brazilian

Fig. 58.



species); the head is of moderate size, horizontal, and rounded behind (*fig.* 58. 2. front of head); the eyes lateral, prominent, and subglobose; the ocelli, two in number, more or less distinct, placed between the eyes, the third ocellus being subobsolete; the antennæ short, with about twenty submoniliform joints, the basal joint being the largest (*fig.* 58. 9.); the clypeus and labrum are distinct (*fig.* 58. 2.), the latter produced over the mandibles, and subtriangular in form, with the sides rounded. The mandibles (*fig.* 58. 3.) are horny, flattened, and triangular in form, with several teeth on the inner edge; the maxillæ (*fig.* 58. 4. under, 58. 5. upper side of the maxillæ) are flat, horny, and terminated by two strong hooked teeth, and defended by a very broad external lobe or galea (*fig.* 58. 4. 5. ×.); the maxillary palpi are rather longer than the maxillæ, filiform, and 5-jointed; the labium (*fig.* 58. 6. beneath, 7. laterally) is very perfect in its formation, being of large size, and occupying the greater portion of the under surface of the head; the mentum is coriaceous, transverse, with the fore mar-

gin rounded ; the labium itself is divided at the apex into four nearly equal conical lobes; and the labial palpi are filiform and 3-jointed. Within the mouth, attached to the inner base of the labrum, arises a large coriaceous lobe (*fig.* 58. 7. o. and 58. 8. detached), somewhat emarginate in front, and which is the lingua, here as fully developed as in the saltatorial Orthoptera and Libellulidæ.

The three thoracic segments are distinct; the prothorax of moderate size, shield-like, and either transversely quadrate or semicircular, with the anterior margin straight, and the posterior rounded; the meso- and meta-thorax are of nearly equal size; the wings are nearly twice as long as the body, narrow, and of equal size, they are not so hyaline as in the majority of the insects of this order; the costal and subcostal nerves are very robust, but all the other nerves are but slightly visible; when at rest they are carried flat upon the back; the legs are rather short, slender, and simple; the tibiæ are cylindrical, with two or three spurs; the tarsi (*fig.* 58. 10.) are 4-jointed, the three basal joints being very short and hairy beneath; the abdomen is flattened, with transverse segments, and terminated at the sides by two minute conical 2-jointed styles (*fig.* 58. 11. The figures 58. 1—11. are taken from the large Brazilian species figured.)

With the exception of two or three small species of this family (T. lucifugus *Rossi*, T. flavicollis *Fab.*, and T. flavipes *Kollar* in *Isis*, 1833), these insects are chiefly confined to the tropics, where the immense numbers of which their communities consist, together with their devastating powers, render them the most absolute pests of mankind. They attack furniture, wood-work, and merchandise of every kind; and their instinctive powers are so great, that every particle of furniture in a house may be destroyed without their presence being even suspected, as they form their burrows under ground, and make their places of exit immediately beneath the legs of tables, &c., of which they completely eat away the interior, leaving only a thin outer shell, which crumbles to dust on being moved. The nests of these insects are of a very large size, and varied in form according to the species. That of T. fatale *Linn.* (Bellicosus *Smeathm.*) is sometimes not less than ten or twelve feet high, of a conical form, with numerous conical turrets on its sides; it is formed of clay, and, being soon coated with grass, looks like a haycock. The strength of these nests is so great that, when raised to little more than half their height, it is the practice for the wild bulls to mount upon them as sentinels, whilst the rest of the

herd is feeding; and Smeathman and four of his companions mounted on the top of one of them to obtain a view of any vessel which might come in sight. The nests of T. atrox and mordax are cylindrical pillars, three quarters of a yard high, with a projecting roof; whilst T. destructor *Fabr.* (T. arborum *Smeathm.*) constructs its nests of different sizes, amongst the branches of trees, seventy or eighty feet high. T. viarum appears, from the observations of Smeathman, to reside in holes in the ground. T. lucifugus makes its lodgements in the trunks of pines and oaks, in which they form a number of irregular burrows. Dr. Burmeister showed me a colony of T. flavipes at Berlin, which he kept in a flat earthenware jar filled with rotten debris, and covered with damp pieces of wood, in which the insects burrowed.

The societies of these insects consist, according to Latreille (who investigated the economy of T. lucifugus, which he discovered at Bordeaux), of five kinds of individuals, namely: 1. *Males*, and, 2. *Females*, closely resembling each other externally, and agreeing with the characters given above; 3. Individuals, described by Smeathman and Fabricius as pupæ, but called neuters by Latreille and Kirby, and soldiers by Smeathman (*fig.* 58. 14. T. flavipes), having a soft, elongate, oval body, destitute of wings, and a head of gigantic size, armed with long and powerful sickle-shaped jaws, in which the under, as well as the upper, side of the head is horny, with the maxillæ and labrum very minute, and the palpi long and slender. My *fig.* 58. 15. represents the under side of the head of T. flavipes in which the upper lip is long and entire; but in another species, from Fernando Po, in my collection, it is very deeply notched (*fig.* 58. 16.); the eyes appear entirely wanting; the parts of the mouth of these members have not been previously described. These individuals are much less numerous than the workers, being in the proportion of 1 to 100. They are employed as sentinels and soldiers, making their appearance when the nest is invaded, attacking the intruders, and inciting the labourers to work. 4. Apterous individuals, called larvæ by Latreille, Kirby, &c., and workers by Smeathman, very much resembling the winged individuals, but with the head larger and rounded; the eyes and ocelli wanting; the mandibles not larger than in the winged individuals; the thorax, with the three segments, distinct and wingless (*fig.* 58. 12. T. flavipes); these are considerably smaller than the so-called neuters, and are the most numerous and most active portion of the community; they are the workers and architects of the nest; they collect food,

form covered ways, guard the males and females, and take care of the eggs and young: and, 5. Pupæ, first observed by Latreille, and described by him as resembling the workers, but having four white tubercles on the back of the meso- and meta-thorax, in the shape of rudimental wings. In a small African species from Fernando Po, of which the nest is in the museum of the Rev. F. W. Hope, the pupæ (*fig.* 58. 13.) are furnished with 4-wing tubercles extending beyond the body, with large lateral eyes. These individuals bear a great resemblance to some of the perfect Cercopidæ; no other figures have hitherto been given of these insects in this state. Latreille found these pupæ in the nests of T. lucifugus in the spring; and in the month of June following, the winged individuals make their appearance in prodigious numbers, swarming during the evening and night; the latter shortly afterwards pair, and after impregnation, the females (as in the ants, with which these insects possess a very great analogy), lose their wings, which easily fall off*; they are then made prisoners by the workers, in order to become the founders of fresh colonies, and conducted into the interior of the nest, where the body of the female becomes swollen to an enormous size, exceeding by 20,000 or 30,000 times the bulk of one of the workers, when she commences laying her eggs; the amazing number of 80,000 being discharged in the course of twenty-four hours. From these circumstances, Latreille (*Hist. Nat. Ins.* vol. xiii. p. 65.) was led to believe that the fourth kind of individuals, or the workers of Smeathman, are larvæ; that the fifth kind are pupæ; that the soldiers are a peculiar order which never acquire wings, and are not capable of reproduction, being thus analogous to the neuters of the bees and ants; and that those specimens which are met with, without wings, in the nest, after the period of pairing, are females which have pulled off their wings, and have survived the process of oviposition.

The nature of these various kinds of individuals, however, requires a more minute investigation than it has yet received. Burmeister well observes, that there is no other instance in the whole animal world in which the undeveloped young labour for the old; and is thence induced to doubt that the workers are really larvæ, to which may be added the circumstance that these so-called larvæ still retain their

* The account given by Mr. Davis of insects, like Nemouræ, lighting in swarms upon a ship at anchor off Bahia in Brazil, and biting off their wings, appears to relate to a small species of Termes. (*Ent. Mag.* No. 24.)

form when the winged individuals appear. Kirby indeed suggests, that as these insects belong to an order whose metamorphosis is semi-complete, the office of working for the society may devolve upon the larvæ (*Introd.* vol. ii. p. 30.); and Latreille endeavours to account for the circumstance that, at the time of the winged individuals coupling, a great number of specimens remain in the nest under the form of larvæ, by supposing that these 'ne doivent subir leur dernière métamorphose que l'année suivante;" making them to be two years in arriving at perfection, which is, however, but a mere supposition. As to the large headed individuals, their right to the name of neuters has been doubted by Huber. (*Nouv. Obs.* vol. ii. p. 444. note *.) Kirby says that in all respects they bear a stronger analogy to the larvæ than to the perfect insects, and after all may possibly turn out to be larvæ, perhaps of the males (*Introd.* vol. ii. p. 34. note *); and Burmeister observes that he does not see why these neuters should be merely defenders, as the neuters amongst all other social insects are the true workers (*Manual of Ent. Transl.* p. 533.). As to the individuals which have lost their wings, Burmeister, who dissected one of them, did not find the least trace of external or internal genitalia, and is thence induced to believe that they are real neuters. I cannot, however, adopt this opinion, nor the hypothesis which he has founded thereon, as I am inclined to think that his investigation of the internal anatomy of the individual was not sufficiently precise, and that this specimen was a male or female which had lost its wings in the usual way. Moreover, his hypothesis does not account for the existence of the large headed individuals. On the other hand, I would even venture to suggest, from a knowledge of the modifications to which some individuals of the Orthoptera, Hemiptera, and Hymenoptera are subject, that these large headed individuals, as well as the so-called larvæ, remain permanently apterous, without altering their form *, being like the wingless specimens of Velia currens retarded in their transformations, their development stopping short before their arrival at maturity, and thereby some individuals gaining an enlarged head in order to compensate for their ultimate want of wings; and that the real larvæ of the comparatively few specimens, which ultimately become winged, are as yet unknown.†

* The want of rudimental wing-cases and the structure of the head and mouth of the soldiers seem to me to prove this completely, at least as regards these individuals.

† The larvæ and neuters of Termes Viarum are described by Smeathman as possessing eyes.

The reader who would learn more ample particulars relative to the natural history of these insects, their various duties, the internal economy of the nest, and their wonderful instincts, must consult Smeathman's *Memoir* above referred to, Kirby and Spence's *Introduction*, vols. i. and ii.; and Latreille's *Hist. Nat.* vol. iii., as well as my article Termitidæ in the *Brit. Cyclop. of Nat. Hist.* The species of this family are evidently more numerous than has been supposed, but they require a more rigorous investigation than has hitherto been given to them. Some exotic species (*fig.* 60. 16.), having 3-jointed tarsi, wings not longer than the body, and the anterior legs dilated (60. 18. 17. maxilla), compose the genus Embia *Latr.* They seem more nearly related to the Perlidæ. They form the subject of my monograph, published in the *Linnæan Trans.* vol. xvii.

The family PSOCIDÆ * *Leach.* comprises a rather numerous series of minute insects, at once distinguished by the almost obsolete labial palpi; the 2 or 3-jointed tarsi; the smaller size of the posterior wings, which are not folded, and by the slenderness of the antennæ, which are long and setaceous, composed of about thirteen joints; the first of which is the largest, the third the longest, and the remainder gradually diminishing in length; the upper lip is large; the mandibles (*fig.* 59. 2. 3.) horny, trigonate, with a tooth near the tip inside, and another (much stronger in one jaw than the other), near the base inside; the maxillæ (*fig.* 59. 4.) are elongated, fleshy at the tip, and armed with a long, slender, curved, horny process, arising from the base, and longer than the maxillæ; the maxillary palpi are 4-jointed; the labial apparatus (*fig.* 59. 5.) is large; the mentum is a large leathery plate, reaching to the base of the head beneath; the labium subquadrate, with a deep, longitudinal, central impression; the sides are rather rounded, and the middle, in front, produced into

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* BIBLIOGR. REFER. TO THE PSOCIDÆ.

Latreille, in Bull. Soc. Philomat. an. 3. Nos. 41. and 42. — Ditto, in Coquebert. Illustr. Iconogr. Ins. tab. 2.

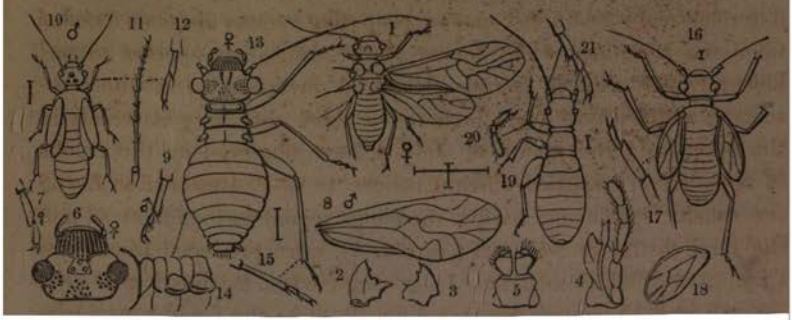
Phil. Trans. 1693, Allen; 1701, Derham; 1724, Stackhouse. (Atropos pulsatorium.)

Nitzsch., in Germar, Mag. Ent. vol. iv. (Anatomy Atropos pulsator.)

Carpenter, in Mag. Nat. Hist. No. 10.

Stephens, Curtis, Fabricius.

Fig. 59.



two lobes, at the side of which two small rounded lobes are attached; the labial palpi have been described by Latreille and Curtis as wanting, but they appear to me to be represented by the last-mentioned pair of lobes; the eyes are of moderate size, semiglobose, lateral, and prominent; the ocelli are three in number, and placed in a triangle between the eyes (*fig.* 59. 6.); the body is short, gibbose, ovate, and soft; the prothorax is very short; the meso- and meta-thorax larger and deeply impressed; the wings are hyaline, deflexed, with conspicuous veins; the anterior larger than the posterior, with a large stigma, and a few irregular, longitudinal, and transverse nerves; they are often variegated and coloured; the lower wings are not folded; and the veins are differently arranged to those of the anterior pair; the abdomen is short, ovate, and convex, the ovipositor, which exists in the females, enclosed in two valves, not being exserted; the legs are long and slender; the tarsi 2 or 3-jointed.

These minute insects frequent the trunks of trees, palings, old walls, stones covered with lichens, old books, &c., for the purpose of feeding, either upon the still more minute animalculæ, which inhabit those situations, or, more probably, upon the decaying vegetable matter to be there met with. They are extremely active, and when approached they endeavour to hide themselves by running to the opposite side of the trunk of the tree, or other object on which they are stationed. The perfect insects are produced towards the end of the summer, when they sometimes appear in great numbers. The larvæ and pupæ are equally active with the imago, from which the former differ in being apterous, whilst the pupæ have rudimental wings.

Latreille published a monograph of these insects in Coqueberit's

Iconography; and more recently Curtis, and especially Stephens, have described many additional species, proposing various divisions founded upon the variation of the nerves of the wings. It appears to me, however, that a more minute structural investigation of these insects is required, as I am inclined to think they vary materially in the sexes. In the month of July, I have observed on the trunks of apple trees a species which I believe to be P. 4-maculatus *Latr.;* the smaller specimens, having the wings veined as in *fig.* 59. 8., and the tarsi, distinctly 3-jointed (*fig.* 59. 9.), were produced from pupæ (*fig.* 59. 10), which had four long wing-covers, 2-jointed tarsi (*fig.* 59. 12.), and 13-jointed antennæ (*fig.* 59. 11.); the females, as I presume them to be of the same species (*fig.* 59. 1.), were larger, with the veins differently arranged, and with 2-jointed tarsi (*fig.* 59. 7.). I found in company with these insects a number of specimens in the state represented in *fig.* 59. 13., and which, from their large size and the markings of the head, destitute of ocelli, I presume are the pupæ of the females, although the small size of the rudimental wing-cases, and of the meso- and meta-thorax (*fig.* 59. 14. thoracic segments laterally), together with the 3-jointed tarsi (*fig.* 59. 15.), might lead to the opinion that these individuals will never acquire wings; the structure of their mouths also agrees with that of the females. If my supposition, as to the specific identity of all these individuals, be correct, the genus Cœcilius of Curtis must be rejected, being founded upon a sexual character.

M. V. Audouin has communicated to me an observation made by him, in which a female winged Psocus was seen to weave a web over its eggs, which it had deposited in the impressed parts of leaves formed by the veins of the leaf. Likewise that, in another species, the eggs, eight in number, were arranged on a leaf in an irregular circle, with the tips all pointing to the centre of the circle. In the month of August, I have found amongst old papers specimens of a minute species in the state agreeing with *fig.* 59. 13., having four minute rudimental wing-cases, but with 2-jointed tarsi. These insects I presume to be fully developed females of the insufficiently characterised Atropos fatidicum; with them I found many specimens still smaller, with a more slender body, and with only two rather short rudimental wing-cases (*fig.* 59. 18.), as well as a single specimen (*fig.* 59. 16.) agreeing with the latter, except that the two wings were larger; the nerves more distinct; the tarsi only 2-jointed (*fig.* 59. 17.);

this I presume to be the male, and the preceding the male pupa of the same insect, which, from a consideration of its characters, I have separated as a distinct genus, named after Lachesis, one of the Fates.

The Atropos pulsatorius (*fig.* 59. 19.) is a minute, almost colourless insect, found in great numbers in ill-preserved collections of insects, plants, old books, &c., to which it is very injurious, by eating all the more minute portions; the different shape of the head, and proportion of the thoracic segments destitute of wings, united with its 3-jointed tarsi (*fig.* 59. 21.), and thickened hind legs, well distinguishes it from Psocus. Latreille, however, throws out a hint that it may be the larva of Psocus abdominalis *Fab.* (pedicularius *Latr. Hist. Nat. Ins.* vol. xiii. p. 71. and 73.), which scarcely appears to me to be possible; although, from what I have noticed above, as to the variations occurring in Psocus, it is impossible to assert that such is not the case. I have noticed that they are killed in a very short time, when shut up in a box with camphor. This species is commonly called the death-watch, from its habit of making a slight tapping noise like the ticking of a watch, somewhat similar to that made by the species of Anobium. There are several papers in the early volumes of the *Philosophical Transactions*, above referred to, upon this subject.

The genus Coniopteryx, placed by Curtis and Stephens in this family, evidently belongs to the Hemerobiidæ.

The family PERLIDÆ * *Leach*, is of small extent, comprising but few species of moderate size (*fig.* 60. 1. P. marginata), distinguished by the large size of the posterior pair of wings, which are folded, the 3-jointed tarsi, the existence of labial palpi, and the ordinarily rudimental state of the mandibles, and membrano-coriaceous structure of

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* BIBLIOGR. REFER. TO THE PERLIDÆ.

Pictet. Mém. sur les Larves des Nemoures, Ann. Sc. Nat. August, 1832. —Ditto. on Perla, in ditto, January, 1833.—Ditto, in Mém. Soc. Physiq. et d'Hist. Nat. Genève, vol. vii. (new Nemouræ.)

Newman, in Entomological Magazine, vol. i. p. 415. (Isogenus.) Vol. iii. p. 500. (Chloroperla). Vol. v. p. 175. (Pteronarcys and other North American species). Vol. vi. p. 401. Likewise a monograph of the caudated species about to be published.

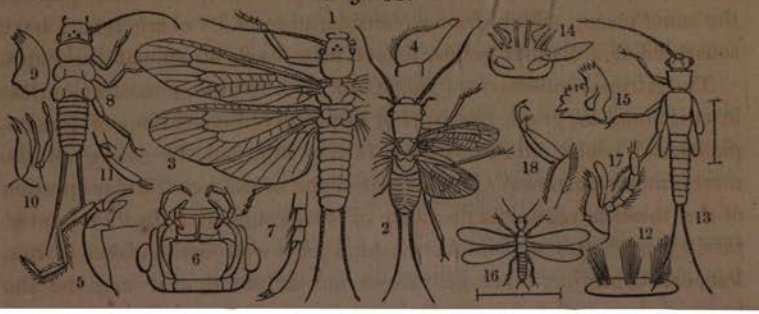
Suckow, in Zeitschr. Organische Phys. t. ii. No. 3. March, 1828.

Lucas, in Ann. Sc. Nat. December, 1832, t. xxvii.

Westwood, in Griff. An. Kingd. (Eusthenia.)

Stephens, *Olivier* (Enc. Méth.) *Curtis*, &c.

Fig. 60.



the other parts of the mouth. The body is oblong, depressed, and of equal breadth throughout, the head (*fig.* 60. 3. under side) being flat, as broad or broader than the prothorax, which is large, flat, and quadrate; the eyes prominent, semiglobose, and lateral; the ocelli three, in a triangle, between the eyes; the antennæ nearly as long as the body, and multiarticulate; the basal joint being largest, and the third and following exceedingly short; the upper lip is transverse, and very short; the mandibles in Perla are small, flat, and membranous (*fig.* 60. 4.). In a beautiful Australian species, they are horny and toothed (*fig.* 60. 15.), whence I have formed this insect into a distinct genus, Eusthenia spectabilis *Westw.* (*Griffith, An. Kingd.*); in Nemoura they are also horny, and armed with several teeth; the maxillæ are widely apart, with a long basal articulation, and two short and slender terminal lobes; the maxillary palpi are slender, and 5-jointed (*fig.* 60. 5.); the mentum (*fig.* 60. 6.) is large, covering the greater part of the under side of the head; the labium is smaller and quadrate, deeply slit down the middle; the lingua (overlooked by Curtis) being well developed, not slit, and occupying its internal face; the labial palpi are 3-jointed; the three thoracic segments are nearly equally developed; the abdomen is sessile, soft, depressed, of equal breadth, 9-jointed, and in the large species furnished with two long and slender articulated filaments; the wings are longer than the abdomen, upon which they are horizontally extended at rest, the posterior pair being the largest, and folded; the legs are of moderate length, compressed, and simple; the tibial spurs very short; the third or terminal joint of the tarsi is larger than the two preceding united in Perla (*fig.* 60. 7.); but in Nemoura the joints are of equal length. There is a very great diversity in the sexes of the typical genus Perla, the males being much smaller than the females, with very short wings (Curtis and Lucas, in *Ann. Sc. Nat.*,

Dec. 1832; *fig.* 60. 2. P. cephalotes ♂ *); the latter circumstance also occurs in Nemoura trifasciata *Pictet.* These insects frequent damp marshy situations, and the borders of lakes and rivers, resting upon stones, palings, and plants, growing close to the water's edge; they are sluggish in their movements, and the larger species are well known to the angler as an excellent bait for trout; Perla bicaudata appearing in April, being called the Stone-fly; Chloroperla viridis in May, termed the Yellow Sally; and a species of Nemoura in September, called the Willow-fly. (*Ronald's Flyfisher's Entomology.*) Curtis gives the name of Willow-fly to Chloroperla viridis.

In their preparatory states, these insects reside in the water: the female, according to Scopoli (*Ent. Carn.* p. 705.), Suckow, and Curtis, carries a globular bundle of little black shining eggs at the apex of the abdomen, enclosed in a valve or bag; such is also the case with the Ephemeræ. In the works of Geoffroy, Olivier, Fabricius, Latreille, &c., the transformations of these insects are described as being similar to those of the Phryganeæ; namely, having a cased larva, and an inactive pupa; and Mr. MacLeay, misled by this statement, has united the Perlidæ in the same order with the Phryganeæ, with which, indeed, they agree in the large size of the posterior folded wings, and the weak structure of the mouth. The error originated with Reaumur, who reared a small bicaudated Perla in a vessel, in which "M. l'Abbé Nollet avait mis ou cru n'avoir mis que nos teignes à fourreaux dont l'envelope est une espèce de ruban vert roulé," or a cased larva of one of the Phryganeæ. (*Mémoires*, tom. iii. p. 178. pl. 13. f. 12. and pl. 14. f. 8. 9. and 10.) It is evident, from a reference to Latreille's *Hist. Nat.* vol. xiii. p. 47., that his statements relative to the transformations of this group are derived from the memoir of Reaumur above referred to, and the history given by Geoffroy (*Hist. Abrégée des Ins.* tom. ii. p. 230.); but Geoffroy himself informs us in p. 233., that the history which he gives of the genus is that of "la perle jaune," an insect only two lines long, and which evidently does not belong to the family.

These statements, however, at least so far as the present family is concerned, are incorrect; the larvæ of the Perlidæ being naked, not

* In a beautiful species from Van Dieman's Land, which I have received from Mr. R. H. Lewis, the females are occasionally furnished with only short wings. One thus constructed, in the collection of the Rev. F. W. Hope, has a bundle of eggs still attached to the extremity of the abdomen. (Eusthenia diversipes *W.*)

enclosed in a case, and in general form resembling the imago, except in wanting wings; whilst the pupa is active, having a still greater resemblance to the imago, possessing the four rudimental wing-cases. In a memoir published by Goeze in *Der Naturforscher*, st. iii. so long ago as 1774, a figure of the pupa of Perla bicaudata was given, answering to this description; and specimens of the pupæ are preserved in the Linnæan collection. I likewise possess several (*fig.* 60. 8.), as well as the exuviæ cast on the insect's arrival at the perfect state, and which are found attached to plants, &c., in the vicinity of the water in which the larvæ and pupæ have resided. Dr. Suckow has also (in a memoir written with the view to prove that the Semblis [Perla] bicaudata, and Semblis [Sialis] lutaria belonged to different genera, as, indeed, they had long been considered by Latreille, and published in the *Zeitschrift für die Organische Physik*) described the Perla bicaudata in its various states. More recently Mr. Newman has given a sketch of the larva of P. bicaudata (*Ent. Mag.* vol. i. pl. 3. f. 10); and M. Pictet has published two memoirs, detailing the history of various species of Perla and Nemoura, agreeing with the character given above. These larvæ prefer the most rapid parts of streams: they crawl about slowly, preferring to remain stationary under stones; they are carnivorous; they shed their skins several times (at least, in Nemoura); and they generally crawl out of the water when about to assume the perfect state. M. Pictet has described these larvæ in detail; it will, however, be sufficient to notice that, unlike the imago, the mandibles in the larvæ of Perla (*fig.* 60. 9.) are robust and toothed, as well as the maxillæ (*fig.* 60. 10.); the eyes are prominent and lateral, and in the place of ocelli I observe three black dots between the eyes, which M. Pictet has not described. The tarsi in the pupæ of Perla (*fig.* 60. 11.) appear to me to be composed of three joints, the two basal ones being very minute, the first almost hidden from view; in the larvæ of Nemoura the tarsi are 2-jointed. M. Pictet has described two singular modifications in the respiratory organs of these insects. In the larvæ of the large species composing the genus Perla, as restricted in my *Generic Synopsis*, each of the three thoracic segments is furnished with a pair of tufts of short external filaments, each tuft being composed of three distinct pencils, each having a distinct origin (*fig.* 60. 12.).

In the Perla virescens *Pictet* (evidently a Chloroperla *Newm.*), and in Perla nigra *Pictet* (which will probably form a different subgenus,

intermediate between Isogenus and Nemoura), the larvæ are destitute of these external organs of respiration.

In Nemoura cinerea *Pictet, Oliv.*, the under surface of the prothorax is furnished with six elongated filamentous sacs (*fig.* 60. 14.), similar to the sacs observed on the abdomen of the larvæ of Phryganeæ. These organs do not exist in the five other species of the genus, of which M. Pictet has described the larvæ, thus proving the slight importance of these modifications of the respiratory apparatus in the Annulosa. The rudiments of the wing-cases are perceived in the enlarged posterior angles of the meso and metathorax of the larva, and the pupa state is only to be known by the increased size of these wing-cases, which "se développent peu-à-peu dans la nymphe." In the genus Perla, as now restricted, these wing-cases are much less distinct than in the P. microcephala *Pict.* (which is, I apprehend, an Isogenus*), Chloroperlæ (P. virescens *Pict.*), P. nigra, and the Nemouræ; in all which the wing-cases in the pupæ are detached, and considerably elongated (*fig.* 60. 13.). The resemblance between the larvæ of the smaller species of caudated Perlidæ, and the Nemoura is so complete, that M. Pictet could not discover any "caractère constant pour les distinguer," although in the perfect state the latter are destitute of the pair of anal filaments which exist in their larvæ. A species of this family, Semblis viridis (Chloroperla ?) has been made one of the subjects of Dr. Carus's observations on the circulation of the blood in insects. (See Spence, in *Mag. Nat. Hist.* Jan. 1830, p. 49. and Carus, *Entdeck. einfach. Herzen besch. Blutkreis, &c.*)

The family EPHEMERIDÆ * *Leach*, comprises the well-known tribe of insects, ordinarily known under the name of May-flies, distinguished

* M. Pictet informs me that he considers the Isogenus Nubecula *Newm.* to be the Perla bicaudata *Linn.*; but this is doubtful, as the Linnæan description is too vague, and the Linnæan collection affords no decisive information.

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Clutius. Opusculum de Hemerobio. 4to. Amsterd. 1634.
Swammerdam. Historie väd het haft (Ephem.) Amsterd. 1675. — Ditto, in Book of Nature, pl. 13, 14, 15.
De Geer. Obs. sur les Ephem. in Mém. Acad. Sc. Paris, tom. ii. Sav. Etr.
Schäffer. Das fligende Uferaas. 4to. Regensb. 1757, and in Abh. von. Ins. 3 b.
Williamson, on Ephemeron Leukon, in Trans. Soc. Philadelphia, vol. v. 1802.
Collinson, in Phil. Trans. 1746. (Eph. vulgata.)

Fig. 61.

by the minute size of the antennæ; the unequal size of the wings; the membranous and almost obsolete mouth; and the elongated articulated setæ at the extremity of the body. The body is long, slender, and soft (*fig.* 61. 1. Ephem. vulgata ♂, with the tails cut partly off); the head small, transverse-trigonate; the eyes large, nearly oval, and lateral, in the males of some species very large, and meeting on the crown of the head *; the ocelli are three in number, and placed in a triangle between the eyes; the anterior ocellus being often small, and the two lateral ones placed on peduncles (*fig.* 61. 16. head of Baetis): the antennæ are small, and 3-jointed; the two basal joints thick; the third forming a long slender seta: the clypeus in some species (Baetis, *fig.* 61. 16.) is large, fleshy, and shutting over the mouth with

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Curtis, in Taylor's Philos. Mag. 1834. — Ditto, Brit. Ent.
Dryander. Libr. Banks. sub Ephemera.
Stephens, *Savigny* (Egypt), *Fabricius*, *&c.*

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* The males of Ephemera bioculata *L.*, in addition to the ordinary eyes, have the head furnished with two short, thick, erect pillars, on the top of which another pair of large eyes are fixed. Mr. Curtis doubts whether this insect has four wings; and the figure given by De Geer, vol. ii. tab. 18. f. 9., represents an insect with only two wings, although it has its head represented with pillared eyes. Geoffroy's figure, vol. ii. tab. 13. f. 4., has four wings, two anal setæ, and two very large eyes. The insects which appear to me to accord with the Linnæan description, have four wings; but the posterior pair are very minute, with only two longitudinal nerves. The nerves of the anterior wings are exceedingly delicate; and between each pair of the longitudinal nerves, at the tip of the wing, there are two very short nerves unconnected with any transverse nerve. These characters will be sufficient for the formation of this species into a separate genus, which may be named Brachyphlebia. It is perhaps equivalent to Stephens's section B of Baetis. The Linnæan specimens are destroyed.

a thickened rib half way down the centre, and slit through the frontal half. As the life of these insects ordinarily extends but for a few hours, the parts of the mouth are almost obsolete, being minute, fleshy, and filled with fluid, so that their structure is not easily discernible. Latreille describes them doubtingly, as consisting of four short multi-articulate palpi, more slender at the tip. Mr. Curtis having examined living specimens, says that the parts of the mouth seem to consist of two large triarticulate? palpi, with two compressed elongated sublinear lobes between them (maxillæ, *fig.* 61. 2.), and a dilated labrum with two large divaricating fin-like lobes (palpi? *fig.* 61. 3.). Reaumur's figure of the under side of the head (tom. vi. pl. 43. f. 11.), represents a space "où devroit être la bouche et d'où on ne fait sortir qu'une vessie, au dessous on voit quatre languettes charnues, dirigées vers la partie postérieure;" and Savigny has represented the parts of the mouth of a Baetis, in the great work on Egypt; but it is impossible satisfactorily to make out their analogies. The thorax is oval and convex; the prothorax small, narrowed in front, the mesothorax large; the abdomen is elongate, narrow, of nine segments in both sexes, the terminal segments being longest, and gradually narrowed; it is furnished at the apex, in both sexes, with two or three long, slender, multiarticulated filaments * (*fig.* 61. 4. ♂.), and in the males with four, two short setaceous articulated appendages, and two shorter straight ones, which are sometimes not exserted †; the wings are of unequal size, the anterior being much larger than the posterior, and elongate-trigonate, considerably reticulated; at rest they are generally carried erect; the posterior pair are wanting in some species (Cloeon, Ephemera diptera *Linn.*). The legs are slender and simple; the anterior pair, in the males being porrected, and greatly elongated, with the tibiæ and tarsi appearing soldered together; the basal tarsal joint being very minute; the tarsi are 5-jointed, simple, and terminated in the fore legs of the males by two oval pulvilli; in the four posterior legs the tarsi are short, 5-jointed; the basal joint (in the males of E. vulgata), being shortest, and soldered to the tibia (so

* Latreille (*Hist. Nat. Ins.* vol. xiii. p. 80.) states that the males differ from the females in having the middle anal filament very short, whereas it is as long as the others in the females. This is the case in a species observed by Reaumur; but in the true Ephemeræ, the middle seta is nearly, but not quite, as long as the lateral ones

† In Eph. vulgata ♂, they have been overlooked by Curtis, but the extremities are distinctly exserted in my specimens. I have seen no species with three of these short appendages as described by Latreille, *Gen. Cr.* vol. iii. p. 184.

as to make the tarsi appear 4-jointed, as, indeed, they have been described by some authors), and terminated by a large oval pulvillus, and a single broad notched claw.

Dr. Leach formed these insects, in his MSS. (quoted by Stephens, *Syst. Cat.* p. 305.), into a separate order, named Anisoptera, from the unequal size of the wings.

Cuvier, followed by Duméril, united them together with the Phryganeæ, into a distinct section of the order, termed Agnathes, from the rudimental structure of the mouth, destitute of jaws; whilst Brullé united them with Libellula and Termes into a separate order, which he named Dictyoptera.

These insects have obtained their name Ephemera, from the Greek Εφημερος, diurnal, in allusion to the extremely short space of time* which they occupy as perfect insects. Their elegant flight in swarms (composed, as in the gnats, almost entirely of male insects) in fine afternoons, over or near water, alternately rising and falling, must have attracted the attention of the most incurious: in this operation the upward flight is produced by the repeated action of the wings; but in descending, the wings are widely extended, as well as the tails. A few hours previously, they had been the inhabitants of the water, from which, in the pupa state, they had crawled to the surface, where they cast off their pupa skin, appearing at first sight to be fully developed, with the wings extended to their full size (which state is termed by Mr. Curtis the pseudimago); they then make their way, flying with difficulty, to the shore, where they affix themselves to the trunks of trees, stems of rushes, walls, or even upon persons standing upon the bank, when they again cast off a very delicate pellicle, in which they had been entirely encased, and which remains, unchanged in form, attached to the objects on which they had stationed themselves: the skin, however, in which the wings had been enclosed, shrivels and curls up into a mass, hanging down at the sides of the thorax; after this process, the wings, disengaged from the outer covering, assume a brighter appearance, and the tails grow to twice their previous length.

* De Geer kept Ephemera vespertina alive for eight days; and Mr. Stephens mentions having kept specimens of Cloeon dipterum alive above three weeks. Had these individuals, however, been at large, and capable of pursuing their natural habits, I doubt not that their existence would have been as short as that of their companions. Dr. Franklin's beautiful address, supposed to have been delivered by an "ancient Ephemera," which had lived four hundred and twenty minutes, is one of the most profound lessons to humanity ever published.

In some specimens which I have reared, I have invariably found that the casting off of this pellicle takes place during the night. In some species, the operation of shedding this pellicle takes place immediately after flight, and is so quickly performed, that the whole operation does not exceed three minutes; immediately after which the insect again takes wing. (Davis, in *Ent. Mag.* vol. ii. p. 322.) I have observed in one instance, at least, that the insect remained in the pseudimago state upwards of twenty-four hours. In consequence of this peculiarity, these insects have been described as undergoing a quadruple metamorphosis.* After coupling has taken place, the females deposit their eggs in a mass, and which they drop into the water. This being the only operation which the perfect insects are able to perform, they die as soon as it is accomplished.

Notwithstanding the dangers to which the eggs, larvæ, and pupæ are constantly exposed, from the attacks of fishes and predaceous aquatic insects, the number of specimens which arrive at the per-

* Swammerdam asserts of the species which he observed, that the males only undergo this second moulting. I can affirm that in E. vulgata both sexes are subject to it.

This power of flight by the insect, previous to attaining its final form, is perfectly anomalous; and if we were to adopt the opinion expressed by Mr. Newman (*Ent. Mag.* vol. iii. p. 19.), that the pseudimago state of the May fly is analogous to the pupa of the bee, or the chrysalis of the butterfly, it would necessarily follow that the state in which rudimental wing-covers are developed, preceding the pseudimago state of the former, is analogous to the last stage of the *larva* of the latter insects. But Mr. Newman has shown that he is aware of the fact, not only that the dragon fly, on becoming a perfect insect, quits a double skin, the interior of which is analogous to the external pellicle of the pseudimago, but also that butterflies, moths, and gnats, "which do not retain the skin of the previous state, on entering the quiescent state, retain two distinct coverings;" the interior being a soft pellicle, which must have been observed by all who have paid any attention to the rearing of Lepidoptera. But Mr. Newman further contends that the pupa of a bee or beetle is enveloped in only a single skin; whilst the flesh fly, &c. (or the insects which undergo the true coarctate metamorphosis, that is, "on assuming the quiescent state they retain the last cuticle of the previous state,") cast off two skins on becoming perfect insects. Now, both those assumptions are contrary to fact as well as to analogy, since it is certain that the beetles, after quitting the pupa skin, are at first enveloped in a thin pellicle, like the May-fly, and which I doubt not is general, and to be found in the bee, as well as the beetle, if sufficient careful researches were made for it; whilst, at the same time, we are warranted in considering that the real pupa of the flesh fly is likewise inclosed in a similar membrane, so that the latter insect, on arriving at the perfect state, casts three, and not two, skins; namely, the hardened ultimate larva skin, the real pupa skin, and the pellicle analogous to the pseudimago skin of the May fly, which, from its firmer consistence is retained longer by the last-mentioned insect. If this be a correct view of the real nature of the pseudimago state, there will be no grounds for rejecting the Linnæan definitions of metamorphosis.

fect state is sometimes so immense, that the swarms of one species with white wings (E. albipennis) has been compared to a fall of snow; whilst, in some parts of Europe where they abound, it is the custom to collect their dead bodies into heaps, and use them for manure. The fishes at such time eagerly wait for them; and so great are the numbers which fall into the water, that the fishermen call them manna.* They are well known to the angler as excellent baits for trout.† They are also a favourite food of the smaller dragon flies. If, however, the life of these insects in their perfect state is so short, it is of much greater duration in the preparatory states, extending at least, in some species, to two or three years. During this period, they are inhabitants of the water, in which they ordinarily hide themselves, during the day, in the earth, under stones, or in horizontal burrows, divided internally into two canals, each having a separate opening externally, and uniting internally at the extremity, so that the insect can crawl in at one hole and out of the other, without being obliged to make the awkward turn it would have to do, if in a straight hole: these burrows are formed in the earth of the sides of the stream, or standing water, and which circulates freely in them. It is affirmed by some authors, that the larva feeds upon the mud at the sides of its retreat (*Hist. of Insects*, p. 106.). Swammerdam, who dissected these larvæ, always found mud within the stomach and the great and small intestines. It is most probable, therefore, that when the larva has assimilated the decaying vegetable matter therein contained, the earthy particles are discharged. The larvæ bear a considerable resemblance to the imago in their general form, but are easily distinguished by their long multiarticulate antennæ; the want of ocelli; the presence, in some species, of two corneous appendages in front of the head, considered as mandibles, and more

* I must refer to Kirby and Spence's Introduction for various particulars relative to the almost incredible appearance of the swarms of these insects upon certain occasions.

† Out of forty-four species of insects given by Mr. Ronald in his *Fly Fisher's Entomology*, eighteen belong to the present family. Amongst the smaller species, the pseudimago and imago are known under different names. The various kinds of duns are all in the pseudimago state, the name evidently applying to their duller colour. The green drake is the pseudimago, and the grey drake the imago of E. vulgata ♀. See further Sir H. Davy's *Salmonia*, and the late editions of *Isaac Walton*. The females, filled with eggs, are most eagerly seized by the fish; the males, inflated with air, offer them but little nourishment, and are called bastard May flies by the Oxfordshire fishermen. It is rarely that the females are found in the swarms hovering on the water.

particularly by the possession of a row of thin plates on each side of the abdomen, ordinarily united in pairs by their bases, and which are a species of external false branchiæ or gills, in which the tracheæ are extended, and ramify; thus serving as organs of respiration, as well as assisting in locomotion by their constant undulatory motion: the abdomen in the larva is terminated by three setæ, which is the case, not only in those species which have three filaments in the imago, but also in those with only two tails. I have observed that these setæ acquire a greater length at each moulting.

Those species which reside in burrows seldom quit their retreats; whilst the smaller species, which live at large in the water, are much more active, and have the body of a firmer consistence than the others. The pupa differs only from the larva in having the rudimental wing-covers more conspicuous at the sides of the meso- and meta-thorax.

The investigation of the preparatory stages of the different species of these insects, will be sufficient to prove the necessity of their separation into even more genera than have hitherto been proposed for them. The pupæ of several species are represented by De Geer and some other authors: the larvæ, however, are not figured, but we may consider them as similar in character to the pupæ, from which they differ only in the absence of rudimental wing-covers. In the species to which the generic name has been restricted by recent authors (E. vulgata, &c.), the pupa (my *fig.* 61. 5., and De Geer, tom. xxi. tab. 16.), is distinguished by a transverse-quadrate prothorax as broad as the head, a very gibbous meso-thorax, a head of rather small size, with two short horns in front, and two long, acute, slightly recurved mandibles, originating at the sides of the mouth, and being as long as the head (*fig.* 61. 6. head sideways). Considering the rudimental nature of the mouth of the imago, it is surprising that no one has hitherto described the real structure of the mouth, in the preparatory states. Reaumur has attempted it, but his figures are so rude and insufficient, that no idea can be gleaned as to their true structure; Swammerdam, also, passes them over undescribed. In the pupa of E. vulgata, the upper lip is of moderate size, with the anterior angles rounded off, and ciliated; it is flat, and quite membranous (*fig.* 61. 7.); the mandibles (*fig.* 61. 8.) are horny, armed with several teeth within, near the base (*fig.* 61. 9.), which is dilated into a flattened molary plate; whilst the upper angle of the mandible

is produced into the long curved horn above described. The maxillæ (*fig.* 61. 10.) are small, membranous, curved, pointed at the tip, and internally setose; the maxillary palpi do not extend beyond the front of the head; they are 4-jointed, the basal joint being very short; the lower lip (*fig.* 61. 11.) is very large and membranous, covering the underside of the mouth; it is quadrilobed (*fig.* 61. 12.), and furnished within with a broad tongue (*fig.* 61. 13.), of which the anterior angles are produced and pilose; the labial palpi are broad and 3-jointed; the antennæ are about twice the length of the head, multiarticulate, and ciliated; the eyes are large and rounded; the legs are short, broad, and very much compressed; the tarsi 2-jointed, with a terminal hook (*fig.* 61. 14.); the abdomen is 9-jointed, the terminal segments being the longest: of these segments, the six basal ones are furnished on each side with a pair of elongated rather narrow gills, the edges of which are furnished with long, narrow filaments (*fig* 61. 15.), through each of which an air-tube extends to the tip; the air-tubes from each contiguous pair of filaments uniting near the base, and then running to the large tube which traverses the centre of each gill. Each of these pairs of gills are united together at the base, so that in the whole the insect has twenty-four gills. The insect, of which the history is figured by Schäffer (*Abhandl.* vol. iii. pl. 1.), appears to be an Ephemera, with four wings, and three tails, the larva of which forms burrows in the earth; but it is impossible, from his figures, to ascertain either the species or the real characters of the preparatory states.

In a small species figured by De Geer (*Mém.* tom. ii. tab. 17. f. 11—16), having four wings and three tails, the eyes of the male being very large and much elevated, and which is regarded as the E. vespertina (which Mr. Stephens introduces into his second section of the genus Ephemera), the head of the pupa is unarmed; the antennæ longer; the legs and anal setæ longer and more slender; the seven basal abdominal segments are furnished on each side with a pair of oval, flat, membranous gills, each terminating in a long point, and not provided with long marginal filaments (*fig.* 61. 19.). The insect figured by Rösel (*Ins. Belust.* tom. ii. tab. 12. f. 1, 2.) is evidently identical, in the structure of the pupa and imago, with these figures of De Geer. This and the allied species may, perhaps, from the consideration of the variation of their preparatory states, be advantageously separated as a distinct genus, to which the name of Leptophlebia may

be applied, in allusion to the delicacy of the veins of the wings, which are moreover destitute of the numerous transverse veins near the posterior base of the fore wing, so conspicuous in E. vulgata.

The pupa of another species, belonging to the genus Baetis, is figured by De Geer (vol. ii. t. 18. f. 1—4.), and is remarkable for the broad flat head, with short antennæ, and large eyes; the prothorax is very broad and flat; the legs short, with the femora greatly dilated and compressed; and the seven basal abdominal segments furnished on each side with a broadly oval gill, terminating in a point; the six basal ones on each side being further furnished with numerous long floating filaments, representing the other gill (*fig.* 61. 18.); the tails are very long, and not fringed. My specimens (*fig.* 61. 17.) have the head and prothorax considerably broader than they are figured by De Geer, but in all other respects they correspond: in one of these which I dissected, I found the labium very large, completely covering the other parts of the mouth; the mandibles being small, but furnished at the base with a molary plate, as in the pupa of E. vulgata.

Messrs. Goring and Pritchard (*Nat. Hist. Obj. for Microscope*, 1829, pl. 1.) have figured the pupa of a species which they named E. marginata; but their figure of the imago represents it as 2-winged and 2-tailed, thus belonging to the genus Cloeon. The head of the pupa (*fig.* 61. 20.) is small, scarcely more than half the breadth of the mesothorax; the antennæ as long as the body, about 24-jointed; the terminal joints being gradually elongated; the legs long and slender, with 2-jointed tarsi; the five basal abdominal segments furnished on each side with a pair of flattened membranous gills, each being very short (especially the basal one in each pair), the posterior one in each pair being of an elongated oval transverse form: the sixth abdominal segment has on each side a single larger gill; the three apical setæ are long, multiarticulate, and finely setose; the central setæ (as the period for assuming the perfect state approaches) becomes more transparent; whereas the two exterior ones exhibit the two tails of the perfect insect inclosed in them. This pupa feeds on minute aquatic larvæ, as well as on vegetables; the rapidity of its motions is astonishing, employing the six double paddle-like gills as oars, and for the purpose of balancing itself, and the posterior pair as paddles; it likewise possesses the power of leaping or springing in the water to a considerable distance. I have observed these pupæ to possess the power of darting both forwards and backwards with equal rapidity. This insect in its earlier larva state (in which the thoracic and basal

abdominal segments are of equal size) has formed the subject of a valuable paper upon the circulation of the blood, by Mr. Bowerbank. (*Ent. Mag.* vol. i. p. 239.)

The larvæ and pupæ figured by Rösel (*Ins. Belust.* tom. ii. tab. 12. f. 3, 4.) seem, at least so far as they can be determined from the figures, to be similarly constructed to the pupa figured by Goring and Pritchard; the head being of moderate size, and the anal filaments deeply fringed; but the imago (fig. 6.) is represented as possessing four wings and two tails: so that either the genus Baetis, as even now restricted, must comprise several distinct types, or Rösel must have erred in giving four wings to his imago.

The species which afforded Swammerdam materials for his admirable history of the Ephemera, abounds to an astonishing extent in the rivers of Holland and Germany, and makes its appearance regularly, in swarms, at the mouths of the Rhine, Meuse, Wael, Leck, and Ysel, during three succeeding days, about the feast of Olophius and St. John. It is considerably larger than E. vulgata, with four wings and two long hairy tails; and has been named E. Swammerdiana by Latreille, in honour of its historian. It clearly belongs, however, to a distinct genus; its larva burrowing in the ground, with short broad legs, and its head cornuted (see tab. xiv.): the first abdominal segment is not furnished with gills, but each of the six succeeding segments has a pair on each side; the posterior in each pair being very small, and termed by Swammerdam rowing fins. The male pupa differs from the female in the larger size of the head, and especially of the eyes.

Reaumur (*Mémoires*, tom. vi. Mém. xii. tab. 42—44.) has given numerous details of a large species, which in several material respects differs from any of the foregoing; it has four wings, and three tails, which in the female are of equal length, but in the male the central one is not half the length of the abdomen: the abdomen of the male is armed at its extremity beneath with a pair of straight appendages of considerable length, in addition to the pair of articulated forceps; the meso- and meta-thoracic spiracles are of large size; the female deposits her eggs in two long oval masses. The larva burrows in ground at the sides of the rivers, and has short broad legs, the mandibles are greatly elongated, curved, and armed along the under surface with two rows of small points, and an apparently articulated hook at the tip; and the gills are of an elongated kidney shape, narrowed

towards the extremity with broad short ciliæ, and a large air-tube running down the centre of each; the two plates on each side of the segment are of nearly equal size. Reaumur has also represented (pl. 45.) another pupa, with simple head and long legs, and in which the gills form a large and broad plate, which is ordinarily folded so as to appear like two narrow plates. He has not described the imago of this species. In the following plate, he has figured two other kinds of pupæ, in one of which (whose imago is not given) the mandibles are very broad, porrected, and dentated, and the gills formed as in the pupa of E. vulgata. The other species appears to be a Cloeon like Goring and Pritchard's figure, but the gills of the pupa are represented like those of E. vulgata.

The family LIBELLULIDÆ *, comprises an extensive and beautiful group of large-sized insects, well known under the common names of

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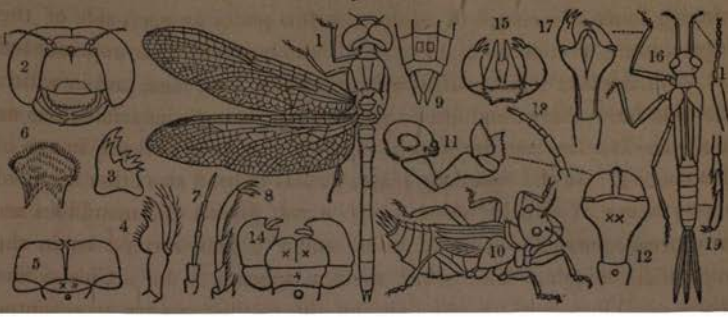
† M. Charpentier has shown me a thick folio volume of drawings of the different species of this family, of which he is preparing a monograph.

Fig. 62.



horse stingers and dragon flies, the first of which is founded upon a vulgar error; the second is more fancifully correct, as the insects, both in their appearance and voracious habits, are certainly more entitled to the name of dragons than that of "demoiselles," as they are called by the French. The body is very much elongated, narrow, and nearly linear; the head large, semiglobose, or transverse-subtrigonate; the thorax thick and deep; and the abdomen long, with inarticulate apical appendages (*fig.* 62. 1. Libellula Scotica); the antennæ are short, and very slender, with from five to eight joints, of which the two basal ones are the thickest; the terminal ones being subulate (*fig.* 62. 7.); the eyes are very large, uniting on the top of the head (*fig.* 62. 2. head of L. depressa; the figures 62. 2. to 13. represent details of this species). The upper facets are of a larger size than the lower; Mr. Ashton has communicated a memoir upon this structure of the eyes, in these and some other insects, to the Entomological Society. The ocelli are three, the two lateral ones placed at the sides, and the anterior one in front of a vesicle on the forehead. The mouth is well described by Latreille, as being "larvatum," or masked; the lips (especially the lower one) being of a large size, and the palpi not elongated beyond the mouth (*fig.* 62. 2.); the upper lip is transverse, with the angles rounded off; the mandibles (*fig.* 62. 3.) are horny, very thick and powerful, and multidentate; the maxillæ (*fig.* 62. 4.) are more elongated, dilated in the centre, armed with strong terminal teeth, and destitute of an external lobe, the place of which is supplied by the maxillary palpus, which is short, thick, and hirsute, apparently only shortly articulated at the base, and terminated by an acuminate point; the lower lip (*fig.* 62. 5.) is singularly constructed (the true labium, ××, arising in Æshna, from a distinct piece (*fig.* 62. 14. ×, which is obsolete in Libellula),

and consisting of three lobes, of which the centre one is deeply cleft in Agrion * (*fig.* 62. 15.), but entire in Æshna and Libellula ××; the two lateral lobes are flat and horny, with an articulation at the base, and of a very large size in Libellula (*fig.* 62. 5.), meeting and slightly crossing each other in front of the middle lobe; at the inner anterior angle of these lateral lobes is a small horny point, accompanied, in Æshna (*fig.* 62. 14.) and Agrion (*fig.* 62. 15.), by a short inarticulated appendage.† Within the mouth, the lingua (*fig.* 62. 6.), or the palatum of Latreille, appears distinctly of a large size, leathery, vesicular, and villose. The prothorax is reduced to a very short and small piece; whilst the meso- and metathorax (not the mesothorax alone, as stated by Latreille, *Gen. Cr.*, vol. iii. p. 180.), are large, subcylindrical, vertically compressed, and oblique; the wings are large, of equal size, and exceedingly closely reticulated; the anal angle of the posterior pair being often acuminated in the males. Van der Hoeven has published a short note relative to the distinctions existing in the neuration of the wings of Æshna, Libellula, and Lindenia, consisting of a small triangular space inclosed by strong nerves near the base of the fore wings. A careful comparative examination of the nerves of the different species will clearly prove its existence, not only in the fore wings, but also in the posterior wings, of all the Libellulides, with this difference, that in the posterior wings, a supplemental piece, forming the anal angle, is added, so that the cells, analogous to those of the anal angle of the fore wings, are pushed out of place. When at rest, they are either horizontally extended or carried erect over the abdomen; the legs are short, slender, and armed with numerous slender spines; the tarsi are 3-jointed, the basal joint being the smallest (*fig.* 62. 8.); the abdomen is long, and either lanceolate-depressed, or subcylindrical, armed at its extremity with folioles or hooked appendages, variable in form, both in the sexes and species. In the males, the organs of ge-

* By this name I here more especially mean L. virgo, which is the true type of Agrion *Fab.*; although Leach injudiciously formed it into the genus Calepteryx, retaining Agrion for other insects.

† The singular construction of the labium renders the analogical investigation of its parts very difficult: we may regard these three lobes as forming a trilobed ligula, in which case, however, the horny point at the internal angle of the lateral pieces must be regarded as appendages, and not as palpi, as Latreille regarded them (*Gen. Crust.*, vol. iii. p. 180.), because the labial palpi never arise from the extremity of the lateral lobes of the ligula. In such case, perhaps the outer part of the maxilla would rather represent the galea, the palpi being obsolete. On the other hand, we may, with M. Brullé (*Ann. Soc. Ent. de France*, tom. ii. p. 343.), regard the outer lobes as enormously dilated labial palpi.

neration have been ordinarily described as of very complicated structure, and as occupying the under surface of the base of the abdomen. They have been described in detail by De Geer, Reaumur, and especially by Rathke. Burmeister, however (*Manual of Entomol.*, p. 218.), asserts that these organs are only those of excitement, and that the real male organs are placed within the ninth * abdominal segment, in an aperture closed by two valves on the ventral surface of this segment (*fig.* 62. 9.).

These insects are distributed over all parts of the globe; few, however, exceed in beauty or size the inhabitants of our own country; a peculiarity common to other aquatic tribes.

The elegant appearance of these insects on the wing; their varied colours, in some, of a rich blue ("the beautiful blue damsel-flies" of Moore); their delicate gauze-like wings, and their rapid flight, must have attracted the attention of every one. During the hottest days of summer they are to be observed darting backwards and forwards in the air, especially in the neighbourhood, or over standing water, where they find an ample supply of food in the myriads of insects which are there generated. The admirable adaptation of the form of the various parts of the body, namely, the powerful structure of the mouth, large size of the eyes and wings, and length of the rudder-like abdomen, has been happily treated by Mr. Newman (*Ent. Mag.*, vol. ii. p. 67.). There is considerable diversity in the colours of the sexes of some of these insects, the males having the abdomen of a lead blue, whilst the females are rich yellow-brown. In some of the Agrionides, the males, which fly over the water in swarms, are of a rich blue, with black wings, whilst the females are fine green, with colourless wings. (See also Schelver in Weidemann's *Arch. Zool.*, st. 2.) The partiality of these insects for various colours is noticed by Mr. Patterson (*Ent. Trans.*, vol. i. p. 82. app.).

These insects live in the perfect state a considerable period. In the summer of 1833, I noticed, during several weeks, a solitary specimen of Anax formosa hawking over a small pond on Wandsworth Common; and, from the rarity of the species, I have no doubt that it was the same insect. Mr. Ingall has mentioned to me an instance in which a specimen, destitute of a head, and of which the

* It is in the eighth, and not the ninth, abdominal segment that these valves are placed. Burmeister's mistake has evidently originated in the *apparent* articulation of the basal segment.

abdomen was suspended only by a small portion of membrane, flew to a considerable distance after a pin had been passed through the thorax for six hours.

The pairing of these insects is effected in a singular manner; the male seizing the neck of the female by means of the hooks at the extremity of the body, and thus for a time the two insects fly about in a line, at length, however, the female curves the body, sothat the under side of its extremity is brought into contact with the organs placed at the base of the abdomen of the male. Burmeister, however, asserts that these proceedings are but preliminary, and that copulation takes place in the ordinary manner (and see *Drury*, vol. i. p. 114. 2d edition).

The female, after impregnation, deposits her eggs in the water, into which she intrudes the extremity of the abdomen so as to attach them to the stalks of plants, &c.; sometimes even, according to an account with which I have been favoured by Mr. Patterson, the female Agriones descend to a considerable depth below the surface. (See *Ent. Trans.*, vol. i. p. 82. app.) I have observed these females, in the act of oviposition, beat their tails upon the surface of the water with rapid succession, until the eggs form a mass like a bunch of grapes.

In their preparatory states, these insects reside in the water, and have to a certain extent a resemblance with the imago. The body is more or less elongated, according to its form in the perfect state (*fig.* 62. 10. pupa of L. depressa, *fig.* 62. 16. pupa of Agrion virgo); the eyes are of moderate size; the ocelli wanting; the antennæ filiform (not setaceous, as in the imago), and 7-jointed (*fig.* 62. 13.—*fig.* 62. 18. antenna, and *fig.* 62. 19. tarsus of pupa of Agrion virgo); the parts of the mouth are not dissimilar to those of the perfect insect*, with the exception of the lower lip, which is formed into a remarkable mask-like elongated appendage, which completely shuts in the mouth, to which, when unemployed, it is closely applied (as in *fig.* 62. 10.); on extending it, however (as in *fig.* 62. 11. and *fig.* 62. 12., seen from beneath), it is found to consist of, 1st, a basal piece (or cardo) by which it is united to the under side of the head; 2ndly, an elongated piece dilated in front, and concave beneath, so as to close upon the former;

* In the pupa of L. depressa (*fig.* 62. 10.), the labrum is transverse, with the lateral angles rounded off; the mandibles triangular, horny, with several small apical teeth; the maxillæ are slender, with five acute apical teeth, and an inarticulated palpus, of equal length with the maxillary lobe; and the tongue distinct, as in the imago. The mandibles and maxillæ are much more strongly toothed in the pupæ of the Æshnæ.

and 3dly, a pair of transversely triangular pieces, toothed along the inner margin, and articulated at the outer angles of the preceding piece, so as to be capable of being widely opened. The use of this curious instrument, of which the insect has the power of opening and closing the various parts with the greatest facility, is to seize its prey, which consists of other aquatic insects, and even of small fishes (*Mag. Nat. Hist.*, No. 28.), which are immediately brought within reach of the jaws. The parts of which this organ is composed are analogous in their general structure of the different groups, to those composing the lower lip of the imago; thus, in Agrion virgo (*fig.* 62. 15. labium of imago, *fig.* 62. 17. labium of pupa), the central piece is deeply notched, and the lateral pieces are terminated by four acute spines.* (See Brullé, in *Ann. Soc. Ent. de France*, tom. ii. p. 343.) The basal part, by which this organ is attached to the head, appears to represent the mentum, the following more elongated piece, the labium (ligula), and the two terminal parts, the labial palpi. The sides of the meso- and meta-thorax are soldered together, and dilated into a large lateral plate.

The mode of respiration in these insects during their preparatory states is singular. The abdomen is terminated, in the larger species, with five corneous plate-like appendages of unequal size, and conical form, three being much larger than the others, which the insect has the power of separating or bringing into contact, so as to form a pyramidal tail. On opening these pieces, a valve, previously closed by three membranous plates, is opened, and a quantity of water passes into the body, when they are closed; shortly afterwards, however, the water, from which the insect has extracted the oxygen by the assistance of various internal organs communicating with the tracheæ, is discharged with considerable force to the distance of two or three inches, by the action of an inclosed organ, which Reaumur calls "le tampon." This discharge has the effect of giving a progressive motion to the body.

In the Æshnæ the pupa has the middle plate at the extremity of the body truncated, and armed with two minute points. A memoir by Suckow, on the respiration in Æshna grandis, is noticed in the *Bulletin Sci. Nat.*, June, 1829.

* In the genus Agrion (L. Puella), the mask of the larva has a single projection on the upper edge of the mentum; in Lestes a double projection exists; and in Calepteryx (L. virgo) it has a triangular excision at the tip, terminating in two points. (*Stephen's Brit. Ent.*, vol. vi. p. 78.)

In the Agrionides the abdomen of the larvæ and pupæ are terminated by three narrow elongated plates (*fig.* 62. 19..

The preparatory states of these insects last for ten or eleven months; during which, according to Latreille, the skin is cast several times (but Drury states that he had not observed this shedding of the skin). When nearly arrived at the period for assuming the perfect state, the wing-cases become detached from each other, and exhibit traces of the mesh-like appearance of the inclosed wings. The pupa creeps up the stem of some aquatic plant or stone, when about to assume the imago state; after a few hours remaining in this situation, it attaches itself as firmly as possible to the spot by means of its ungues, the head being uppermost; the skin of the thorax then slits, and the inclosed pupa gradually disengages itself, throwing its head backwards; which position it retains for a considerable period, being retained in its situation by the terminal rings of the abdomen, which remain still within the pupa skin; it then gains an erect position, draws out the remainder of the abdomen, and remains stationary for an hour or two, until its pendant wings have assumed their full size and consistence.

Rösel has given figures of various species of Libellulæ, Æshnæ, and Agriones, in their different states (*Ins. Belust.*, vol. ii.; *Ins. Aq.*, tab. 2—11.); De Geer also (vol. ii.); Reaumur (*Mémoires*, vol. vi.); Lyonnet (*Mém. Posth.*, pl. 18.); Guérin (*Icon. R. An. Insectes*); Frisch (vol. i. pt. 8. pl. 8.); Swammerdam (tab. 12.); and Drury (vol. i.), have given figures and descriptions of the preparatory states of various species of dragon flies.

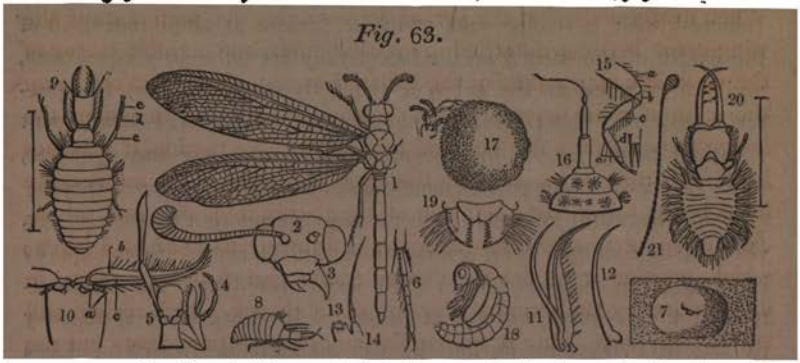
Fabricius formed these insects into a distinct class (order), named Odonata.

Dr. Leach has divided them into two families; but it appears to me to be more natural to consider them constituting one family, corresponding with the Linnæan genus, divisible into two subfamilies. The exotic species do not offer any material peculiarities, if we except some species of tropical Agrionides, which have the abdomen nearly six inches long, and very slender and cylindric.

Dr. Leach also, many years ago, divided these insects into several additional genera, which have not been adopted by foreign writers; but I have little doubt that corresponding characters would be found to distinguish the genera of Libellulides, in the preparatory stages, as well marked as those which I have noticed above in the genera of Agrionides.

The family MYRMELEONIDÆ * comprises a considerable number of large and handsome insects, none of which are ascertained to be natives of this country, and which are known, in their larva state, under the name of ant-lions (fourmilions). The body of the perfect insect (*fig.* 63. 1. Myrmeleon formicarium, natural size, *fig.* 63. 1—19.

Fig. 63.



represent details of this species) is long and slender; the head small, with prominent lateral eyes, and destitute of ocelli; the antennæ longer than the head, multiarticulate, and thickened at the tip (*fig.* 63. 2.); the upper lip is rounded at the sides, and attached to the head by a distinct clypeus; the mandibles (*fig.* 63. 3.) are horny, curved to the tip, with a strong tooth below the internal apex; the maxillæ (*fig.* 63. 4.) are elongated and bilobed; the inner one compressed and ciliated; the external lobe or galea biarticulated; the maxillary palpi slender, short, and 5-jointed; the labium (*fig.* 63. 5.) is large and square, arising from a narrowed mentum, and furnished with a pair of very long labial palpi, arising from the base

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* BIBLIOGR. REFER. TO THE MYRMELEONIDÆ.

Percheron. Larva of Myrmeleon, in Guérin Mag. Zool., pl. 59.

Poupart. Hist. Formicaleo, Acad. Rég. Paris, 1704.

Latreille. Genera Crust., &c., vol. iii. p. 191.

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Schaeffer, on Ascalaphus, 4to. Regensb. 1763, and in his Abhandl., 2 band.

A. Blanchard. Note sur l' Ascalaph. Italic, in Bull. d' Hist. Nat. Soc. Linn. Bordeaux, No. 1.

Argelini (in Biblioteca Ital., tom. xlvii.) Ascalafi Italiani con Nuova Specie.

Newman, in Ent. Mag., No. 24. (Stilbopteryx.)

Drury, Charpentier, Fabricius, Donovan, &c.

of the labium, and 3-jointed; the basal joint being very short, and the other two of equal length, being nearly as long as the antennæ; the internal lingua is distinct and membranous; the prothorax is smaller than the head, and transverse; the two other segments form an oval mass; the wings are large, and densely reticulated, and often coloured, with a strong vein, which is furcate at about one fifth of the length of the wing from the base; they are of nearly equal size, and are deflexed at the sides of the body when at rest; the posterior pair not being folded; the legs are of moderate size, with 5-jointed tarsi (*fig.* 63. 6.); the abdomen is very long and cylindric, often terminated by a pair of long slender inarticulated appendages.

These beautiful insects, in the delicate reticulation of their wings, vie with the dragon flies, whilst their habits render them equally interesting; it is, however, in their larva state, that they have attracted the greatest share of attention, as in the perfect state they fly but little, keeping during the day amongst the leaves of trees and plants, and coming abroad only at dusk; indeed, Mr. Guilding states that after a long-continued search he never found a single imago in a state of liberty, although the larvæ swarmed in St. Vincent's, so successfully are they secured from every enemy by their peculiar mode of resting, and the favourable colour of their bodies.

The larva * is of a form totally unlike the imago, being short, thick, and fleshy (*fig.* 63. 9.); the sides furnished with numerous bundles of short rigid hairs; the head and prothorax narrow; and the meso- and meta-thorax and abdomen forming a very large oval mass, so as to bear a considerable resemblance to a spider; the head is oblong, with six tubercular eyes on a short footstalk (*fig.* 63. 13.) on each side; the head is attached to the prothorax by membrane capable of great distention and motion; the antennæ are very short, slender, and multiarticulate, arising from a thickened base (*fig.* 63. 14.); the mandibles are longer than the head, very slender, and curved, forming a pair of toothed calippers, wherewith the insect seizes its prey. On the under side they are grooved, and within this groove the maxillæ, which are still more slender, are placed, and in which they play backwards and forwards; there appear to be no rudiments of maxillary palpi; the lower lip is short, and furnished with a pair of 4-jointed palpi, of which the basal joint is large and ovate, and the three terminal joints slender (*fig.* 63. 10. represents the under side of the head of the larva,

* Donovan (*Nat. Misc.*, pl. 139.) has described the larva as an apterous female.

a being the labial palpus, *d* the mandible, and *c* the maxilla *in situ;* and *fig.* 63. 11. represents the maxilla partially, and *fig.* 63. 12. entirely, extracted from its groove in the mandible); the legs are long and slender, the two anterior pair being directed forwards; but the posterior pair are shorter and stronger (*fig.* 63. 15.), so affixed to the body that they are not able to assist in progression, but are constantly employed in drawing the insect backwards, which is, in fact, its only motion; the ungues being much stronger than in the anterior legs; and the tarsus (*fig.* 63. 15. *e.*) soldered to the tibia (*fig.* 63. 15. *d.*), whereby greater power is given the limb.* This peculiarity has not been previously noticed. This formation, together with its slow movements and its carnivorous habits, renders the construction of a snare necessary for the support of the insect. Some larvæ of the common species, M. formicaleo, which I brought alive to this country from France, afforded me ample opportunities for watching their proceedings; and of which I have published a notice in *Mag. Nat. Hist.*, Nov. 1838. It is in very fine sand that the larva makes its pitfall. When placed upon the surface, it bends down the extremity of the body (as in *fig.* 63. 8.), and then pushing, or rather dragging, itself backwards by the assistance of its hind legs, but more particularly of the deflexed extremity of its body †; it gradually insinuates itself into, and beneath the sand, constantly throwing off the particles which fall upon, or which it shovels with its jaws or legs upon its head, by suddenly jerking them backwards,

"Ossaque post tergum magnæ jactata parentis."

Proceeding in this manner, in a spiral direction, it gradually diminishes the diameter of its path, and by degrees throws so much of the sand away, as to form a conical pit, at the bottom of which it then conceals itself, its mandibles widely extended, being the only parts that appear above the surface ‡ (*fig.* 63. 7. a small pitfall); with these, any luckless insect that may happen to fall down the hole is immediately seized and killed. When the fluids of the victim are exhausted, the ant lion, by a sudden jerk, throws the dry carcass

* In the fore leg the tarsus is articulated (*fig.* 63. 9. e.)

† Reaumur states that it is able to creep almost as well when its legs are all cut off as when present, the abdomen being the chief means by which its motions are effected.

‡ Mr. Guilding states that those larvæ which dig pitfalls are furnished with antennulæ (above described), which are held erect, and are doubtless useful in indicating the approach of their prey by the falling of the sand; in the larvæ of the Ascalaphi they are wanting or obscure.

out of the hole; should, however, the insect by chance escape the murderous jaws of its enemy, the latter immediately commences throwing up the sand, whereby, not only is the hole made deeper, and its sides steeper, but the escaping insect is probably hit, and again brought down to the bottom of the pit. It is chiefly upon ants and other soft bodied insects that these larvæ feed. They are, however, capable of undergoing long fasts; for one of my larvæ remained from October till March without food. It has been supposed that, as the food of these larvæ consists entirely of juices, and as they appear to be destitute of anal aperture, the whole of their food is assimilated. M. L. Dufour has, however, traced the intestinal canal terminating in an anus, which is, indeed, very difficult to discover. (*Ann. Soc. Ent. de France*, tom. ii. p. 67. app.) Latreille states that these larvæ are produced in the summer or autumn, and become pupæ in the following spring. I found the larvæ of all sizes in July, one of which became a pupa, and assumed the perfect state; whilst another, of equal size, remained through the winter in the larva state. Previous to assuming the pupa state, the larva forms a globular cocoon of less than half an inch in diameter (*fig.* 63. 17.) of fine sand, glued with silken threads spun from a slender telescopic-like spinneret, placed at the extremity of its body (*fig.* 63. 16.), and lined with fine silk. The pupa * (*fig.* 63. 18.) is small, not being half an inch long, inactive, and with all the limbs laid at rest upon the breast. When ready to assume the perfect state, it uses its mandibles (*fig.* 63.19.), which are quite unlike those of the larva and imago, and which have not been before described †, to gnaw a hole through the cocoon, and pushes itself partly through the aperture, in which it leaves the pupa skin (*fig.* 63. 17.). Immediately on assuming the perfect state, the abdomen is almost immediately extended to nearly three times its previous length. Rösel (*Ins. Belust.*, t. iii. t. 17—21.); Reaumur (*Mémoires*, tom. vi. pl. 32—34.); Percheron (*Guérin Mag. Zool.*, p. 59.); Disderi (in *Turin Trans.*, tom. iii.); Bonnet (*Observ.*

* Mr. Guilding observes of Formicaleo (a genus separated by Leach from Myrmeleon), "Nympha dum nocte declaratur, acetabulum elongatum emittens," and in a subsequent page he seems to regard the acetabulum as analogous to the meconium of many animals, noticing also its chemical composition. Reaumur has also noticed it. (*Mém.*, tom. vi. p. 372.)

† Reaumur states that it is after the insect has become an imago that it gnaws a hole through the cocoon and escapes; but, as the pupa skin is found half protruded through the orifice, it is clear that it is whilst a pupa that this opening is made: indeed, this is the only use the pupa has for its mandibles.

diverses sur les Ins., tom. ii.), have given numerous details, and interesting accounts of the habits and structure of this larva.

Bonnet discovered, in the environs of Geneva, specimens of a larva which differed from the common one, in not crawling backwards, but forwards, with the head raised, and in not forming a pitfall; the body is considerably longer, and more pointed, and the hind legs affixed so as not to be so completely concealed beneath the body. (*Bonnet*, op. cit. p. 282.; and *Reaumur*, tom. vi. p. 377.) Latreille thinks it probable that this larva belonged to a species of Ascalaphus, rather than to Myrmeleon; but, from the account given by Mr. Guilding of the preparatory states of the former of those genera, this is evidently not the case. It appears rather to be the larva of M. Libelluloides, or an allied species, agreeing in some respects with the larva of that insect described by Ionicus in the *Entomol. Magazine*, vol. iii. p. 461., and which he states generally feeds upon heteromerous beetles, lurking underground in the sand, without making a pit.

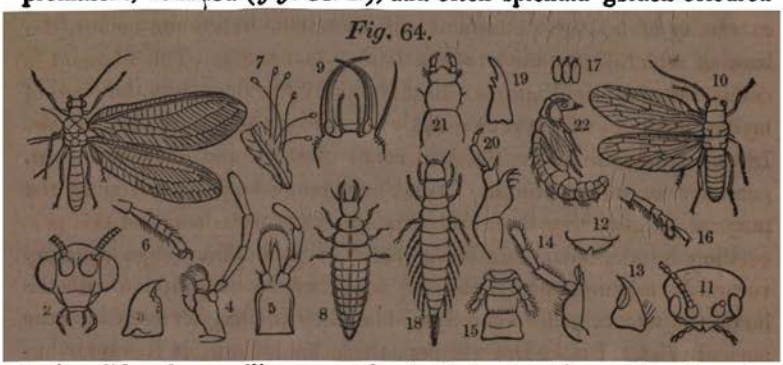
M. Percheron has figured a larva with details, which he gives as that of M. Libelluloides, but it does not accord with the description of Ionicus. Guilding's account of the economy of a species allied to M. Libelluloides (the type of Leach's subgenus Formicaleo), does not materially differ from that of M. formicarium.

The genus Ascalaphus *Fabr.* is remarkable for the peculiar structure of its antennæ, which are very long and knobbed, like those of a butterfly (*fig.* 63. 21.), whence Scopoli and others described one of these insects as a Papilio. Mr. Guilding states that his species A. MacLeayanus sits quietly during the day upon dry twigs, and with its abdomen at an angle so as to resemble a twig, and thus deceive its enemies. The eggs, from sixty-four to seventy-five in number, are deposited at the extremity of the twigs in a double row, and defended from their enemies by "circulis multis repagulorum." These repagula are considered to be without analogies in the animal creation; they are "elongata, pedunculata, subdiaphana, rufescentia;" they are expelled from the ovary by the female with as much care as though they were real eggs, and are so placed that nothing can approach the brood; nor can the young ramble abroad till they have acquired strength to resist the ants and other insect enemies. The abdomen of the larva is depressed and oval, with ten pectinations on each side; all the legs are gressorial —"Larva segnis, corpus pectinesque arenulis tegens, mandibulisque sub lateribus reconditis prædam expectans." (*Linn. Trans.*,

vol. xv. p. 511.) The figures which L. Guilding sent to the Linnæan Society, in illustration of the history of this curious insect, were not published. I am able, however, to give a figure (63. 20.) of a larva contained in the collection of the Rev. F. W. Hope, which is evidently that of an Ascalaphus. The head is very flat, deeply emarginate behind, and the sides of the body are furnished with twelve setose appendages on each side.

The family HEMEROBIIDÆ * (Hemerobidæ *Leach*) is composed of insects nearly allied to the preceding, but having a shorter and more delicate body, broader wings, and long filiform and multiarticulate antennæ (*fig.* 64. 1. Chrysopa perla). The head is small; the eyes prominent, rounded (*fig.* 64. 2.), and often splendid golden-coloured

Fig. 64.



during life; the ocelli are mostly obsolete, but they exist (three in number) in Osmylus; the mouth is powerfully organised; the upper lip large, and rounded at the anterior angles; the jaws (*fig.* 64. 3.) horny and acute, with a tooth below the centre; the maxillæ (*fig.* 64. 4.) long, with the inner lobe broad and ciliated, and with a broad, compressed, hirsute external lobe; the lower lip (*fig.* 64. 5.) is entire and rounded, arising from a distinct leathery mentum; the prothorax

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* BIBLIOGR. REFER. TO THE HEMEROBIIDÆ.

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Newman, in Ent. Mag. No. 22. (Ithone) — Ditto, No. 24. (Drepanepteryx, new species, &c.)

Bowerbank. Circulation in Wing of Hemerobius, Ent. Mag. No. 17.

Griffith. An. Kingdom Ins., pl. 72.

Savigny (Egypt), *Curtis, Stephens, Fabricius.*

forms a distinct piece, narrower than the head and meso-thorax; the abdomen is of moderate length, curved, and not furnished with terminal filaments; the wings large, deflexed at the sides of the body during rest, and much reticulated; the posterior being rather smaller than the anterior, and not folded; the legs are simple and slender, with 5-jointed tarsi, terminated by two claws and a pulvillus (*fig.* 64. 6.).

These insects are of a small, or but moderate size, and appear to be chiefly inhabitants of temperate climes. The exceeding brilliancy of the eyes of some species, resembling polished gold, and the very delicate structure of the wings, which reflect the prismatic colours, are especially worthy of notice. They emit, however, a very disagreeable odour when handled: they fly generally during the twilight, remaining inactive during the day. In their motions they are very sluggish.

The females deposit their eggs upon plants, attaching them at the extremity of a long slender and stiff footstalk, of a white colour, the base of which is fastened to the leaf (*fig.* 64. 7.). This filament is composed of a viscid matter, discharged by the female at the time of laying her egg, which very quickly hardens on exposure to the air. In this manner they are fixed in small clusters, and have all the appearance of minute fungi. It has been suggested that it is for the purpose of protecting them from the attacks of parasites that this proceeding is adopted. The larvæ hatched from these eggs are very voracious, feeding upon Aphides; and thus, in conjunction with the larvæ of the Coccinellidæ and Syrphidæ, they are very serviceable to the agriculturist. Unlike the ant lion, these aphis-lions, as Reaumur has termed them, are wanderers, seeking their prey where it is to be found in the greatest abundance. The body (*fig.* 64. 8.) is long and depressed, with the segments very distinct, and gradually narrowed to the extremity of the body; the head of moderate size, and armed with long curved mandibles, wherewith the insect seizes and sucks its prey. No description of the mouth of these larvæ has hitherto been given, Reaumur merely stating that the mandibles are hollow, for suction. Such is not, however, the case; the under side of these organs is deeply grooved, and the maxillæ, which are nearly equal to them in size, and of a similar form, play in this groove; there are no maxillary palpi; — the labial palpi are long, porrected, and apparently 3-jointed; the antennæ are also long and filiform, but I cannot clearly perceive any articulations (*fig* 64. 9. under side of front of head of larva). So ravenous are these larvæ that it does not require more than half a minute for them to suck one of the largest Aphides. They will

also attack each other, the conqueror in like manner sucking the body of the vanquished. The head is capable of very considerable movements, owing to the flexibility of the neck. During the summer, it does not require more than fifteen days for them to arrive at their full growth. They assume the pupa state immediately after finishing their cocoon, in which they remain, as inactive pupæ, during the winter. M. Audouin has informed me that the manner in which the imago makes its escape from its cocoon is not by a head-piece scaling off, but by a slit at one end of the cocoon being continued in a spiral direction, forming a narrowed and elastic slip. See also Reaumur (*loc. cit.*); Sowerby (*British Miscellany*, pl. 66. larva of Hemerobius —?); Haworth, in *Ent. Trans.*, p. 62.; Disderi (in *Turin Trans.*, vol. iii.); Albin (pl. 64.); Goedart (No. 104.); De Geer (in *Der Naturforscher*, tom. iii. t. 3.).

The perfect insect of Chrysopa perla has afforded to Mr. Bowerbank the subject of a valuable paper on the circulation of the blood of insects (*Entomol. Mag.*, vol. iv. p. 178.; and see Tyrrell in *Proceedings of Royal Society*).

M. Rambur has shown me specimens of two species of a new genus of this family, captured by him in Andalusia, in which the antennæ are strongly bipectinated.

Reaumur (*Mém.*, tom. iii. pl. 32, 33.) has represented four different kinds of larvæ belonging to this family; but, unfortunately, it is impossible to ascertain what are the species to which they respectively belong, with the exception of one, which is evidently that of Chrysopa perla. In one of these larvæ the sides of the segments are furnished with short bundles of hairs *, of which the others are destitute. One of these is naked, and of an elongated depressed form (like *fig.* 64. 8.); whilst another is equally naked, but much more convex, employing the extremity of the body as a seventh leg, and having the segments more continuous. The larva of Chrysopa perla is also convex, but it covers itself with the carcasses of its victims, which gives it a most ludicrous appearance, and at the same time renders it almost invisible amongst lichens, &c. When full-fed these larvæ inclose themselves in globular or oval cocoons of silk, spun from the spinneret, at the extremity of the body, and which in some species are exactly like open network. Compared with the perfect, insect, the small size of the cocoon and pupa appears extraordinary,

* Frisch represents the larva of C. perla as furnished with fascicles (vol. i. st. 3. fig. 23.).

the cocoon not being larger than a small pea, whilst the imago is nearly an inch long.

F. Stein has described the pupa state of Osmylus maculatus (the largest British species of the family), which is found in damp earth in the banks of ditches; when preparing to undergo its final transformation, it quits its abode, and creeps up the stems of grass. (Weigman's *Arch.*, vol. iv. p. 332.).

A singular genus of minute species, which I first described under the name of Coniortes (*fig.* 65. 1. C. tineiformis), (*Proceed. Trans. Ent. Soc.*, July 1834; subsequently figured by Curtis under the name of Coniopteryx, *Brit. Ent.*, 528. December, 1834, and by Wesmael under that of Malacomyza), appears to me, although placed by Curtis and Stephens in the family Psocidæ, to belong to the Hemerobiidæ, with which it agrees in its head (*fig.* 65. 2.); 5-jointed tarsi (*fig.* 65. 7.); multi-articulate antennæ; labrum (*fig.* 65. 3.); mandibles (*fig.* 65. 4.); and maxillæ (*fig.* 65. 5.). It differs, however, in the slight reticulation of the wings; their white mealy covering (exhibiting no appearance of ciliæ, hair, or scales); the large size of the terminal joint of the labial palpi; the obsolete labium (ligula) (*fig.* 65. 6.); the absence of tibial spurs; and the smaller size of the posterior wings. The species sit with the wings deflexed, and feign death by bending their antennæ under the body. Mr. Curtis has figured a singular larva (*fig.* 65. 8.) belonging to this genus, communicated by Mr. Haliday, who thinks it is probably aphidivorous, and entertains no doubt that it is the larva of C. tineiformis. He says its general character is closely allied to the larva of Hemerobius, but the structure of the head appears to me to be very different. The following note has been since kindly communicated to me by the latter gentleman. "Coniopteryx tineiformis, when preparing for transformation, spins an orbicular pouch of fine white silk of close texture generally on the trunk of a tree, in chinks of the bark, or among moss. The pupa is quiescent (*fig.* 70. 1.)"

The family SIALIDÆ * *Leach* consists of a few species of moderate or large size (*fig.* 64. 10.—22. Sialis lutaria, and details), constituting

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* BIBLIOGR. REFER. TO THE SIALIDÆ.

Suckow, in Zeitschr. für die Organ. Phys., tom. ii. No. 3.

Pictet, in Ann. Sci. Nat., second series, tom. v.

the tribe Megaloptera (Latr., *Nouv. Dict. d'Hist. Nat. Tabl. Méth.*). They are distinguished by the larger size of the quadrate prothorax; the palpi are short and filiform, the last joint not being larger than the preceding; the head of moderate size (*fig.* 64. 11.); the labrum is cleft in the centre (*fig.* 64. 12.); the jaws horny, with a single sharp apical tooth (*fig.* 64. 13.); the maxillæ are terminated by two minute lobes; the maxillary palpi in Sialis are 4-jointed (*fig.* 64. 14.); the labium is large, with reflexed 3-jointed labial palpi, the true labium (ligula) not extending beyond the palpi, but internally dilated (*fig.* 64. 15.); the anterior wings are of large size, either deflexed at the sides (Sialis), or carried nearly horizontally (Corydalis, &c.), the posterior pair are rather smaller than the anterior; the antennæ are long, filiform, and multi-articulate; and the tarsi are 5-jointed, either with the joints simple, or with the fourth joint lobed beneath (Sialis, *fig.* 64. 16.) The ocelli are absent in Sialis, but they exist of a large size in Corydalis.

These insects are very slow and inactive in their movements; they frequent the neighbourhood of water, in which they pass the larva state. The ordinary species (Sialis lutaria *Linn.*), is a well-known bait with the angler, being produced in the spring months in great quantities. It is of a dull brown colour, and may be found upon walls or palings near the water. The female deposits an immense quantity of eggs, which she attaches one by one to rushes or other aquatic plants; they are of a cylindrical form, terminating at the top in a sudden point; they are attached together side by side with the greatest regularity (*fig.* 64. 17.). The larva (*fig.* 64. 18.) inhabits the water, in which it swims well by the assistance of seven (Latreille, De Geer, and my specimens, or eight, according to Pictet) pairs of slender 4- (5- ?) articulated setose filaments, attached at the sides of the abdominal segments, representing the false gills of the larvæ of Ephemeridæ, with which they are evidently analogous in their respiratory action.* The abdomen is terminated by a long and slender

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Gray, in Griffith An. Kingd., pl. 72.
De Geer. Mémoires, tom. iii. tab. 27.
Palisot Beauvois. Neuropt., pl. 1.
Drury. Exotic Entomology, vol. i. pl. 46.
Newman. Entomol. Mag., No. 25.

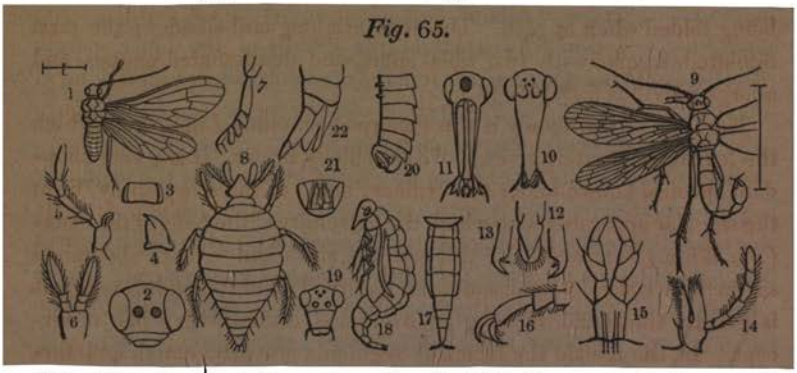
* M. Pictet notices the curious fact, that one of these larvæ lived fifteen days in the earth before it changed to a pupa, being the only instance of an insect furnished with external respiratory organs respiring the ordinary atmospheric air.

setose tail; the legs are of moderate length, and terminated by two claws; the head is scaly, and furnished with eyes and antennæ. The mouth of the larva consists of an angular upper lip; a pair of strong mandibles, armed with two teeth at the middle of the inner margin (*fig.* 64. 19.); the maxillæ are curved, and furnished with a kind of bifid palpus, according to Pictet; but more properly consisting of two lobes, the inner acute, curved, and armed with three strong spines; the outer lobe has its inner angle produced into a point; the maxillary palpus consisting of four joints (*fig.* 64. 20.); the labium, with its short 3-jointed palpi are represented in *fig.* 64. 21.; the above figures being the first which have yet been published of the details of the curious mouth of this insect either in the larva or perfect state. The antennæ are setaceous, and 4-articulated; the three thoracic segments are of nearly equal size; the tenth abdominal lobe constitutes the setose tail. When full grown, this larva quits the water, and burrows into the adjoining bank, in which it forms a cell, wherein it is transformed into an inactive pupa (*fig.* 64. 22.), with the limbs laid along the breast; it is, however, very lively, twisting its tail about when disturbed. The insect assumes its perfect form in its cell (De Geer, *Mémoires*, tom. ii. p. 716.; Rösel, *Ins.*, tom. ii. class 2.; *Ins. Aq.*, tab. 13.; Pictet and Suckow, *loc. cit. supra*; Frisch, tom. i. pt. 8. tab. 14.).

The family comprises two distinct subfamilies: — 1st, the Sialides, described above; and 2d, the Corydalides, having the tarsi simple, three ocelli, and the wings carried nearly horizontally when at rest. The latter insects appear to form a link between Hemerobius and Perla. Latreille considers Corydalis as allied to Raphidia (*Gen. Cr.*, tom. iii. p. 199.). They are of large size, and often handsomely variegated; they are chiefly, if not exclusively, inhabitants of North America. The largest of these (Corydalis cornuta *Latr.*) is distinguished by the immense size of the mandibles in one sex. De Geer's figure 2. pl. 27. tom. iii., evidently represents the head of the female. Chauliodes is distinguished by the strongly pectinated antennæ. There are several other undescribed genera belonging to this section, to which also belongs a species figured in Griffith's *An. Kingd. Ins.*, pl. 72., under the name of Chauliodes maculipennis *G. R. Gray*; but previously described by Say.

The family PANORPIDÆ* *Leach* is at once distinguished by the front of the head being produced into an elongated slender deflexed rostrum

Fig. 65.



(*fig.* 65. 10. 11.), at the extremity of which the parts of the mouth are inserted. The body is moderately long and slender (*fig.* 65. 9. Panorpa communis ♂); the head is vertical, and not broader than the front of the thorax; the eyes prominent and semiglobose (*fig.* 65. 10.); the antennæ long, slender, and multi-articulate; the clypeus is acuminated at the tip, leaving the sides of the leathery ciliated labrum exposed (*fig.* 65. 12.); the mandibles are very small, narrow, toothed at the tip (*fig.* 65. 13.); the lower jaws and lower lip are elongated, the basal parts of the former being soldered together, so as to form the under side of the rostrum (*fig.* 65. 11.); the maxillæ are bilobed at the extremity (*fig.* 65. 14.), membranous, and pilose; the maxillary palpi 5-jointed; the lower lip is inserted upon the united base of the maxillæ (*fig.* 65. 11.), it is narrowed in front, and does not extend beyond the base of the labial palpi, which have been described as only 2 or 3-jointed. I have represented them, in *fig.* 65. 15., as they appear under a strong lens, in a dried specimen. The prothorax forms

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* BIBLIOGR. REFER. TO THE PANORPIDÆ.

Linnæus, in Trans. Holm. 1747. s. 176.
Swederus, in Trans. Holm. 1787.
Westwood, in Trans. Ent. Soc., vol. i. p. 75. app. (3 sp. of Nemoptera.)
Klug. Monograph. Panorpidæ, in Trans. Acad. Berlin, 1836. (See Ann. Soc. Ent. France, 1836, p. 75. app.)
Newman, in Ent. Mag., No. 22. (Merope.)
Pictet, in Mém. Soc. d' Hist. Nat. Génève, tom. vii. p. 403.
Hardwick, in Linn. Trans., vol. xiv. (Panorpa furcata.)
Stephens, Curtis, Fabricius, Thunberg (2 sp. Panorpa.)

a very short narrow collar; the mesothorax is large; the wings are of moderate and equal size, numerously reticulated, the posterior not being folded when at rest. The legs are long and slender; the tarsi 5-jointed, simple, with two tibial spurs, and denticulated ungues, and a large pulvillus (*fig.* 65. 16.).

The type of this family is the Panorpa communis *Linn.*, from which the leading characters given above are chiefly drawn. It is a very abundant species, known under the ordinary name of the scorpion-fly, from the singular apparatus with which the extremity of the body of the males (*fig.* 65. 9.) is armed. In this sex the sixth and seventh abdominal segments are slender, and somewhat recurved; and the eighth segment is greatly thickened, forming an oval mass, armed with a pair of forceps. In the female the terminal segments are attenuated, and furnished at the tip with a pair of very minute 3-jointed filaments (*fig.* 65. 17.). These insects, as far as hitherto observed, feed upon other insects in the perfect state. They are very active, and the elongated abdomen is capable of great motion in every direction, as well as considerable elongation, evidently enabling the female to deposit her eggs in deep holes or crevices. They are generally found in hedges, and amongst herbage, in damp situations. Of the larva state of these insects, no observation has been hitherto recorded. M. Macquart gave a description of the pupa of the common species in the *Annales Sci. Nat.* 1831, tom. xxii. p. 463., without, however, being able to state any thing of its habits, or whether it was quiescent or active; he thought it, however, most probable to be active, because it was provided with limbs proper for motion; its structure, however, clearly showed it not to be aquatic in this state. F. Stein has, moreover, published a figure of the pupa (*fig.* 65. 18.) of the female (as is evident from the structure of the abdomen, although he calls it the male) of P. communis, which he found at the depth of an inch in moist earth, at the foot of an alder stump. From this figure it is evident that it is inactive in this state, the limbs being laid along the breast, and the antennæ along the sides; the head is much less elongated than in the imago (*fig.* 65. 19.) (Wiegmann's *Arch.*, vol. iv. 331.).

The other English genus Boreus *Latr.* (Ateleptera *Hoffmans*), forming the family Boreidæ *Steph.* and the osculant order Raphioptera *MacL.* (*Horæ Ent.*, 439.), comprises a single species of minute size and singular structure, agreeing with Panorpa in the general structure

of the mouth, but remarkably differing in the apterous condition of the female, and the style-like form of the wings of the male. The abdomen of the female is terminated by a 3-jointed ovipositor, the under side of which is defended by a produced valve-like bilobed plate, arising from the under side of the seventh segment (*fig.* 65. 22.), The male (frontispiece, vol. i. *fig.* 3.), has the abdomen (*fig.* 65. 20.) terminated by two short, recurved, attenuated, pilose styles (*fig.* 65. 21.). The antennæ are 23-jointed. This genus differs from all the others in the family by the large size of the prothorax, and the want of ocelli. The period for the appearance of these insects in the perfect state is in the middle of winter. Dalman observes that those found in autumn in moss are pale-coloured and immature, and that the dark-coloured mature ones are to be found on the surface of snow. Stephens states that it has been found in England under moss and stones, at the same period.

The exotic genus Bittacus *Latr.*, in the structure of its mouth and thorax, and possession of ocelli, is closely allied to Panorpa; but its general appearance is that of a large Tipula, resulting from the great length of the legs and wings, which are carried horizontally in repose. The abdomen is alike in both sexes, and the tarsi are terminated by a single unguis. Dr. Klug describes eleven species of this curious and widely distributed genus.

The genus Merope *Newm.* (*Ent. Mag.*, No. 22.), from North America, is certainly referrible to this family; agreeing with Panorpa in the essential structure of the mouth; but the ocelli are wanting; the eyes reniform; the antennæ thickened in the middle; and the prothorax enlarged. The specimen described by Mr. Newman is a female, and has the abdomen terminated as in the female Panorpa; the internal base of the fore wings is furnished with a small incrassated lobe.

Nemoptera *Latr.* comprises some of the most singularly formed species in the order, peculiar to Africa and Western Asia, Portugal, &c., having the wings extended when at rest, the posterior pair being several times longer than the entire body, and linear; the ocelli are wanting; and the structure of the mouth (represented in detail in the great work on Egypt) is very different from that of Panorpa, approaching much nearer in the articulation of the maxillæ and developed ligula, to the Hemerobiidæ; indeed, Dr. Klug has removed it from this family in his monograph. Olivier, who observed them in the Levant, states that their flight is slow and heavy, so that they are

caught without difficulty. They appear in great numbers, and live but a very short time. The Rev. F. W. Hope possesses a singular monstrosity occurring in a specimen of N. coa, in which one of the anterior wings is partially undeveloped.*

It is in this place that I may notice a singular insect, figured by P. Roux in the *Annales Sci. Nat.*, tom. xxviii. pl. 7., under the name of Necrophilus arenarius (*fig.* 66. 1.); but which appears to me to be a Neuropterous larva, exhibiting considerable affinity with the larvæ of the Hemerobiidæ. If the relation of the Nemopteræ with that family be proved, is it possible that this may be the larva of that genus? The body is oval, with a slender linear neck, longer than the entire body; small head; long sickle-shaped mandibles; two antennæ, and six long simple legs. From its size it might either produce a Nemoptera, Bittacus, or Panorpa.

The family RAPHIDIIDÆ† *Leach*, consisting of the single genus Raphidia *Lin.*, is a singular little group, distinguished by the elongated neck-like prothorax, flattened head, and simple fore legs as well as by the elongated ovipositor of the female (*fig.* 66. 2. Raphidia ophiopsis ♂). The head (*fig.* 66. 3. under side of head) is oval and flattened, broader than the prothorax, with prominent eyes placed at the front of the sides of the head; the ocelli, three in number (but wanting in R. crassicornis), are placed between the eyes; the antennæ are slender, filiform, and

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* See for descriptions of species Olivier, *Encycl. Méth.*; Leach, in *Zool. Misc.*, vol. ii.; Ahrens, *Fauna*, fasc. 2.; Savigny, *Descr. de l'Egypte*; Klug, *Monogr. Panorp.* (12 species); Westwood, in *Trans. Ent. Soc.*, vol. i. p. 75. App.

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† BIBLIOGR. REFER. TO THE RAPHIDIIDÆ.

Latreille. Obs. Raphidia Ophiopsis (with fig. of larva), Bull. Soc. Phil. 1798. No. 20. A. 7. p. 153.

Schummel. Versuch ein gen. beschreib. — der gattung Raphidia. Breslau, 1832, 1 pl. 8vo. pp. 16.

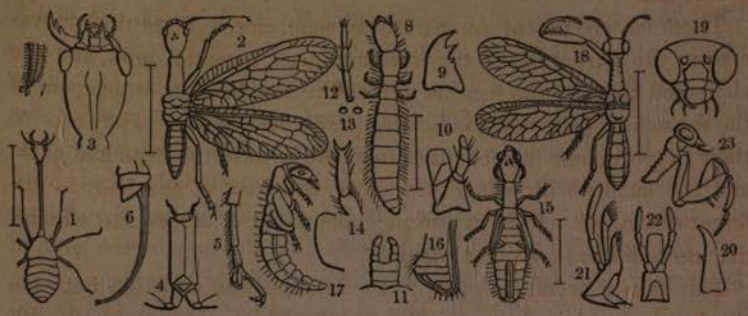
Percheron, in Guérin's Mag. Zool. Ins., pl. 66.

Waterhouse, in Trans. Ent. Soc. London, vol. i.

Stein, in Weigmann's Archiv. für Naturg., tom. iv. pl. 7.

Stephens, Curtis, Schäffer, Panzer, Illiger (Rossi Faun. Etrusc.).

Fig. 66.



multi-articulate; the labrum small and quadrate, arising from a distinct leathery clypeus; the mandibles powerful, curved, and strongly toothed (*fig.* 66. 3.); the maxillæ are terminated by two lobes strongly pilose; the palpi short, filiform, and 5-jointed, the basal joint being very minute; the labium small, with short palpi, of which the terminal joint is longest; the hind part of the head is constricted into a neck or rotula, playing in the anterior aperture of the singular cylindrical prothorax, which is long and narrow, the sides being deflexed, and meeting in the middle beneath, so that one folds partially over the other (*fig.* 66. 4.); the meso- and meta-thorax are much broader, and of equal size; the legs are slender and simple; the anterior pair are inserted at the under side of the prothorax, where its deflexed angles, being cut off, leave a triangular space in front of the meso-sternum (*fig.* 66. 4.); the tarsi (*fig.* 66. 5.) are 5-jointed, the third joint being deeply bilobed, and the fourth joint small, and affixed between the lobes of the preceding. Percheron describes the ungues as composed of two pieces, of which the apical one is moveable; but this is certainly incorrect. The abdomen is sessile, of moderate length, 9-jointed, and terminated in the females by a long sabre-like ovipositor (*fig.* 66. 6.) of a slender construction, composed of two plates (De Geer, *Mém.*, tom. iii. pl. 15. f. 9.) very much compressed, transversely striated, longitudinally ribbed, and terminated by two minute oval appendages (*fig.* 66. 7.); the wings are moderately large, of nearly equal size, the posterior not folded when at rest, when they are deflexed at the sides of the body: they are strongly veined, the veins being inconstant, even in the same individual; but their general arrangement is as in the Sialidæ, &c., with a distinct stigma,

of which the differences of form have been employed as specific characters.

These insects are of comparatively small size, agile in their movements; the astructure of the head and neck, powerful jaws, and the elongated coxæ of the legs, as well as the membranous attachment of the segments of the body, indicating predaceous habits. They receive their English name of snake-flies from the form of the head and neck, and the facility with which they move the front of the body in different directions. It is in the neighbourhood of woods and streams that these insects are chiefly found.

This family seems to occupy an intermediate situation between the larger species of the Sialidæ and the Mantispidæ, agreeing with the former in the enlarged size of the prothorax and structure of the head, and with the latter in general form.

The transformations of these insects have formed the subject of memoirs by Latreille, Percheron, Waterhouse, and Stein.

The larva, for a specimen of which I am indebted to Mr. Ingpen, resides (according to Percheron, who reared two species) *under* the bark of trees; it is predaceous, and feeds upon minute insects *; it creeps but slowly, but gives to its body violent jerking motions in every direction, somewhat like those of a serpent. It is long and narrow (*fig.* 66. 8.), with the abdominal part of the body pubescent, dilated in the middle, and not so scaly as the head and prothorax; it is 13-jointed including the head, which is oblong, flattened, with short 3-jointed antennæ, not including the radicle (*fig.* 66. 12.); the jaws are robust, curved, acute at the tip, with a strong tooth on the inner margin (*fig.* 66. 9.); the maxillæ (*fig.* 66. 10.) and labium are distinct (*fig.* 66. 11.), with short palpi; the legs are short (*fig.* 66. 14. tarsus); the abdomen is unarmed; the eyes resemble ocelli (*fig.* 66. 13.), and are situated near the base of the antennæ. I cannot observe more than two on each side of the head, which is the number also noticed by Waterhouse; Percheron, however, states that there are seven on each side. The pupa is not inclosed in a cocoon. It resembles the perfect insect in general form, but is furnished only with short rudiments of wings, lying at the sides of the body (*fig.* 66. 17. male pupa,

* Mr. Waterhouse states that he always found the larvæ *in* the bark, in which they formed cells for themselves, and that he never observed them to feed upon other insects, although he admits that the structure of the mouth is that of a predaceous rather than a lignivorous insect. I should apprehend that the larvæ noticed by Mr. Waterhouse were preparing a retreat for their pupation.

from Waterhouse, *fig.* 66. 15. female pupa, *fig.* 66. 16. extremity of its abdomen sideways). Linnæus was acquainted with the pupa, which he thus describes: "Pupa currit, matri simillima, licet aptera. Caput obcordatum." (*Syst. Nat.*, tom. ii. p. 916.) Percheron denies that the pupa possesses this active power, and asserts that the entire body of the pupa merely "jouit de la même faculté de contorsion et de sauts, que la larve exécute à un si haut degré." Mr. Waterhouse has (quite correctly as it appears to me from analogy with some other quiescent pupæ, as Myrmeleon, &c.) reconciled these statements by observing that the pupa in some respects approaches the active pupæ, although it cannot be strictly considered as such until immediately before assuming the imago state, when the insect having gained sufficient strength, is enabled to walk, although inclosed within the pupa skin, which, by the bye, is extremely thin. A peculiarity existing in this pupa, which has not been alluded to by previous writers, clearly proves it to be inactive in the early stage of the pupa state, namely, that the hind legs are partially covered by the wings. (Compare *fig* 66. 15. with *fig.* 41. 11. p. 336., or *fig.* 48. 19. p. 387.) The species are very few in number, and I am not aware that any have been discovered out of Europe.

The family MANTISPIDÆ* *Westw.*, like the preceding, consists of a single anomalous genus, whose situation has greatly perplexed systematists, none of whom, however, appear to have given themselves the trouble of investigating the structure of its mouth.† As already noticed, in vol. i. p. 412. note, it is without hesitation that I regard this genus as

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* BIBLIOGR. REFER. TO THE MANTISPIDÆ.

Stoll. Représentation des Spectres, &c.
Serville and *St. Fargeau.* Encycl. Méth., tom. x. p. 270.
Latreille. Genera Crust., vol. iii. p. 94.
Newman, in Entomol. Mag., No. 24.
Charpentier. (Horæ Entomol.)
Guérin, (Voy. Coquille.)

† I must now omit my friend Erichson, who (in his admirable monograph in Dr. Germar's *Zeitschrift für die Entomologie*, No. 1. 1839, just received by me from the author) has investigated the affinities of the genus, and arrived at the same conclusion as myself. He describes twenty-four species chiefly from Africa and America, but I am acquainted with several others yet undescribed.

the type of distinct Neuropterous family, very closely allied to Hemerobius, both in the trophi and in the general character of the veins of the wings. The body is long and narrow (*fig.* 66. 18. Mantispa pagana), somewhat like that of Raphidia, with a broad head, large prominent eyes, short submoniliform antennæ, and an elongated prothorax, narrower than the head, but dilated in front: the ocelli are wanting, the clypeus and labrum distinct; the palpi short and filiform (*fig.* 66. 19. front of the head); the mandibles are horny and acute, but slightly curved, and occasionally with a small tooth within (*fig.* 66. 20.); the maxillæ are long and bilobed: the outer lobe broadest at the tip, where it is subarticulated and pilose; the maxillary palpi are 5-jointed, the terminal joint being longest (*fig.* 66. 21.); the labium is oblong, extending considerably beyond the insertion of the palpi, and entire at the tips (*fig.* 66. 22.); the prothorax is greatly elongated, and formed upon the plan of that of the Mantidæ, but it is not margined; the fore legs are attached on the under side close to the head (*fig.* 66. 23.), they are raptorial, like those of the Mantidæ; the other legs are simple; the tarsi 5-jointed, with denticulated ungues; the wings are of nearly equal size, deflexed at the sides of the body in repose, and numerously veined; the veins being arranged somewhat as in the Hemerobiidæ; the abdomen is not furnished with terminal filaments, or an exserted ovipositor.

The structure of the fore legs and mouth of these insects warrants the conjecture that they are predaceous in their habits. Latreille informs us that they reside upon oaks, their habits, and probably their metamorphoses, being identical with those of Raphidia. M. Bourgeois, who frequently captured M. pagana in the neighbourhood of Lyons, communicated a larva to Latreille, constructed like that of Raphidia, but considerably larger, and which, Latreille says, "je ne peux rapporter qu'à cette Mantispe." (*Considérations Générales*, p. 69.) I have in a preceding page noticed the use which has been made of these insects, with the view of establishing the passage between the Orthoptera and Neuroptera.

The species are but of moderate or small size, of dull colours, and widely dispersed, being inhabitants of Europe, South Africa, India, New Holland, Surinam, Brazil, &c.

ORDER TRICHOPTERA* *Kirby.*

(ELINGUIA *Retzius*, NEUROPTERA PLICIPENNES *Latreille*, SYNISTATA p. *Fabricius*, NEUROPTERA p. *Linn.*, TRICHOPTERA p. *MacL.*)

CHAR. Wings four, membranous; the anterior generally pilose, with branching nerves; the posterior larger, and folded when at rest.

Prothorax very short.

Tibiæ with long calcaria at the tip, and often beyond the middle of the limb in the four posterior legs.

Mouth unfitted for mastication; mandibles rudimental.

Larva hexapod, ordinarily residing in a case formed of various materials, in which it retains its station by means of two hooked anal processes.

Pupa incomplete, inactive during the greater period of its existence.

The insects of this order are the well-known caddice-flies, or water moths of the angler; their larvæ being called cads, or cad-bait, and residing in portable tubes, composed of various extraneous materials.

The body of the perfect insect (*fig.* 67. 1. Phryganea grandis) is of a leathery consistence, and thickly clothed with hair; the head small (*fig.* 67. 2. head of ditto in front), with prominent semiglobular eyes, and three† ocelli. The antennæ are as long as, often much longer

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*BIBLIOGR. REFER. TO THE TRICHOPTERA.

Pictet. Recherches pour servir à l'Hist. et à l'Anat. des Phryganides. Geneva, 1834. 4to. pp. 235, 20 pl. — Ditto, in Mém. Soc. Hist. Nat. Génève, tom. vii.

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Geoffroy, Linnæus, Schäffer, Scopoli, Gmelin, Villers, Olivier (Enc. Méth. tom. vi.), *Fabricius, Leach.*

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† M. Pictet states, "On voit sur le front *deux* petits yeux lisses" (*Recherch. Phryg.*). This is true; but there is a third ocellus between the base of the antennæ in many species, forming, with the two on the forehead, a large triangle; but Curtis describes the Limnephili and Leptoceri as having only two ocelli.

Fig. 67.

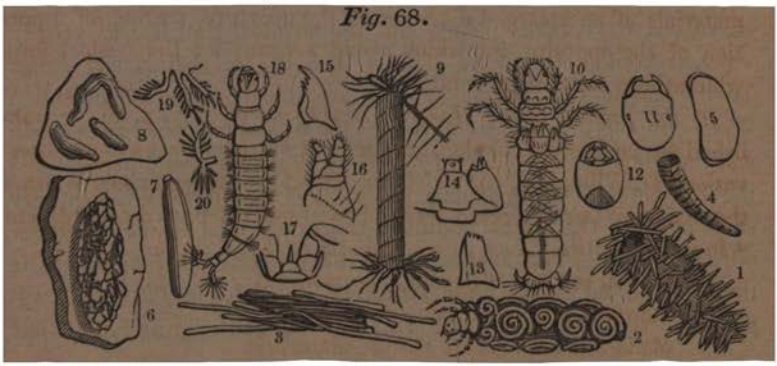
than, the body (as in Leptocerus (Mystacida) niger, *fig.* 67. 7.) slender, setaceous, and multi-articulate. The mouth is neither fitted for mastication nor suction; it consists of an elongated, slender upper lip (*fig.* 67. 3., after Savigny), at the base of which, on each side, according to Savigny (*Mém. An. S. Vertebr.*, pl. 1.), Curtis (*Brit. Ent.*, pl. 592.), and Percheron (*Gen. Ins. Neur.*, pl. 3.), is to be perceived a minute, soft, pubescent, and trigonate organ (*fig.* 67. 3. °°.), which is the representative of the mandibles (which are erroneously stated by Latreille and Pictet to be "nulles"); the maxillæ are also small, and terminated by an oval pubescent lobe (*fig.* 67. 4.); the maxillary palpi are long and slender, being only 4-jointed* in the males of the large species (*fig.* 67. 5.), but 5-jointed in the females (*fig.* 67. 4.). In the genus Phryganea, &c., the joints are of nearly equal thickness, and similar in their appearance; but in Hydropsyche (*fig.* 67. 8. maxillary, 67. 9. labial palpi), &c., the terminal joint is very greatly elongated, and much more slender than the preceding, and annulated; and in the Mystacidæ they are thickly clothed with hairs. The mentum is distinct and quadrate; the labium produced and entire; and the labial palpi 3-jointed (*fig.* 67. 6. P. grandis), and partaking of the character of the maxillary palpi. The prothorax forms a very short collar. The meso- and meta-thorax are dilated into an oval or orbicular mass. The anterior wings are elongated and lanceolate in the females, but rather more obtuse in the males of the true Phryganeæ; they are deflexed at the sides of the body during repose, and

* Pictet describes them as only 3-jointed in the males of the true Phryganeæ. Curtis and Percheron, however, figure them as 4-jointed. In the males of the other genera, they do not differ from the females in the number of joints. In the males of Sericostoma (Phryganea personata *Spence, Introd. to Ent.*, vol. iii. p. 489., Sericostoma Spencii *Steph.*), the maxillary palpi, in the males, are short and dilated, uniting in front of the face, and forming an obtuse rounded mask (*fig.* 67. 10.).

are furnished with numerous branching veins; the costal portion is not transversely veined; the posterior pair are shorter, but considerably broader than the anterior, and are folded when at rest. The wings are more or less clothed with hair (*fig.* 67. 11. fore wing of Hydroptila); the legs are long and slender; the anterior tibiæ are spurred at the tip, but the four posterior are furnished, not only with apical spurs, but also with one or two pair near the middle of the limb; the coxæ are also elongated—both which characters add materially to the activity of the insects; the tarsi are 5-jointed, with minute claws and pulvilli. In the genera Hydropsyche Agapetus, &c., the intermediate tibiæ and tarsi are dilated in the females; this is also especially the case in an allied species figured by Savigny in the *Description de l'Egypte*. The abdomen is of moderate length, slender, the extremity being furnished, in the males, with several short curved inarticulate appendages.

The females deposit their eggs in a double gelatinous mass, which is of a green colour, and is retained for a considerable time at the extremity of the body; the mass is subsequently attached to the surface of some aquatic plant, and Mr. Hyndman has observed the female of Phryganea grandis creep down the stems of aquatic plants under the water, very nearly a foot deep, for the purpose of oviposition; on being disturbed, it swam vigorously beneath the water to some other plants; its bundle of eggs was found to be of an oblong form, bent in the middle, and the two ends attached to the tail of the animal (Curtis, *Brit. Ent.*, fol. 592.).

Fig. 68.



The larvæ ordinarily reside in cylindrical cases, open at each end, to which they attach various matters, as bits of stick, weeds, pebbles, or even small living shells (*fig.* 68. 2. case of P. fusca *Pictet*), by the assistance of silken threads, which they spin from the mouth in the

same manner as caterpillars. Some cases are formed of fine sand, and curved (*fig.* 68. 4. case of Sericostoma multiguttatum *Pictet*). The larva remains in this case, exposing only its head and three anterior segments of the body, and which it suddenly withdraws on the slightest alarm.

The cases formed by these larvæ being ordinarily composed of materials scarcely specifically heavier than the water, are easily carried about. There does not appear to be an exclusive regularity in the choice of the materials of which they are formed, according to the difference of species, the individuals of each employing, occasionally, what comes nearest to them when engaged in its construction. M. Pictet indeed appears to consider that each species chooses its own peculiar materials for the construction of its case, and that the mode in which these articles are applied is uniform. Thus, P. rhombica selects morsels of straws or twigs, which it arranges transversely (*fig.* 68. 1.); whilst P. lunaris employs the same materials, which it attaches longitudinally (*fig.* 68. 3.). He, however, mentions a variety of instances in which materials of a perfectly different kind had been employed by these species. In some species, the materials (ordinarily strips of leaves) are arranged in a spiral coil (*fig.* 68. 9. pupa case of P. varia *Pict. Reaum.* 3. pl. 14. f. 9.).

When the case, owing to the growth of the inhabitant, becomes too small, it has been stated by some authors that the larva quits it and constructs a new one; but M. Pictet considers that it rather adds fresh materials of an enlarged diameter at the aperture, cutting off a portion of the opposite end, which would account for the conical form which these cases often exhibit.

In the preface to the *Historia Insectorum* of Ray, p. xii., is published an interesting tabular arrangement of these cases, "ex observatione D. Willughby," of which an extract will be sufficient to prove the assiduous but neglected researches of our celebrated countryman.

"Insecta aquatica thecis se contegentia sunt, vel theca
immobili, seu lapidibus affixa, corpore vel
subrotundato cum filamentis ad latera,
plano et compressiore absque filamentis.
mobili aut portatili, migratoria; Phryganea vulgo dicta. [Then follows an admirable description of the larvæ inhabiting these moveable cases.] Suntque vel thecis
rectis, vel habentibus
festucas agglutinatas

parallelas [straw-worms]
transversas et breviores, quibus interdum admiscentur lapilli et conchulæ;
festucas nullas adhærentes, sed lapillos aut arenulos quæ vel teretes, [cod-baits]
planæ, seu compressæ,
lapillis majusculis, thecæ lateribus adhærentibus nunquam supinæ aut pronæ parti;
nullis ad latera adhær. lapillis, sed theca utrinque in tenuem marginem, seu limbum procurrente velut alas quasdam, theca planiore et compressiore quam in superiore.
incurvis seu cornutis mavis dicere. Sunt enim horum thecæ incurvæ, et una extremitate majore, altera minore."

The Rev. J. Morton, also, in his *History of Northamptonshire*, chap. vii., has entered into many particulars relative to these larvæ and their cases, as has also Sir Humphrey Davy, in his *Salmonia*. See also *Insect Architecture*, chap. x. Isaac Walton has also given many particulars of these insects, especially as regards their piscatorial qualities, and which he calls cadis, pipers, cockspurs, straw-worms, or ruff-coats. In Mr. Ronald's *Flyfisher's Entomology* various moderate-sized species of Phryganeæ are termed sand-flies, grannums, and cinnamon-flies; whilst one of the Mystacidæ is naemd the silver horns.

The larvæ of these insects (*fig.* 68. 10. larva of Phryganea rhombica *Pictet*) are of an elongated, nearly cylindrical form, with a scaly head (*fig.* 68. 11. upper, 68. 12. under side of head of larva of P. striata *Pictet*), furnished with a bilobed upper lip, a pair of strong mandibles, obtuse at the tip, with several short teeth (*fig.* 68. 13. mand. of larva of P. striata *Pictet*), fitted for gnawing vegetable matters. In the larvæ of Hydropsyche they are terminated by a more elongated tooth (*fig.* 68. 15. mand. of larva of H. senex *Pictet*); and these species are more essentially carnivorous than the others. The maxillæ and labrum are small, fleshy, and soldered together (*fig.* 68. 14. P. striata *Pictet*); the former are terminated by two minute corneous points, supposed by Pictet to represent the terminal maxillary lobe and palpus, of which there is no other rudiment; neither does there appear to be any labial palpi, except two exceedingly minute points on each side of the spinneret, which is also very minute. In the larvæ of the Sericostomæ and Rhyacophilæ, the maxillary lobes are

more elongated; and in the latter of these genera M. Pictet represents the external lobe as articulated and palpiform. My *fig.* 68. 16. represents the maxillæ of the larva of Phryganea pellucida, after De Geer. The head exhibits no trace of antennæ; the corneous covering of the eyes is very small, and apparently composed of points at the sides of the head, and destitute of reticulations; the three thoracic segments of the body are leathery, each being furnished with a pair of legs, the anterior pair of which are shorter and stronger than the others. In the larvæ of the true Phryganeæ there is a slender horn between the anterior legs, which Reaumur considered to be the spinneret, but the use of which has not been ascertained (*fig.* 68. 17. prosternum of larva of P. striata *Pictet*). The nine abdominal segments are more fleshy, being seldom exposed beyond the mouth of the case, in which they retain their station by means of three conical fleshy tubercles on the first segment, and by the two moveable articulated appendages, of variable form, at the extremity of the body. In those species observed by M. Pictet, which reside in fixed cases, these abdominal tubercles are wanting, and the anal hooks are elongated, and placed upon long footstalks (*fig.* 68. 18.), giving them great capacity for movement, and enabling them to fix themselves firmly in their rough and irregular retreats. Other peculiarities exist in the form of this organ in the different genera, which correspond with their various modes of life and movements. The abdominal segments are moreover furnished with white membranous filaments, of various forms, which are the external organs of respiration.

The food of the larva has been stated to consist of minute aquatic larvæ, and such is the case with Hydropsyche, M. Pictet having observed that the larvæ prey upon those of other aquatic Neuroptera, and even upon each other, in a state of captivity; but the greater number are purely herbivorous, the structure of their jaws being fitted for gnawing vegetable matters; and M. Pictet supplied them with willow leaves, upon which they fed well; the larger species devouring the whole leaf, but the smaller ones leaving the veins entire; they would, however, occasionally attack other aquatic larvæ.

From the common occurrence of these caddice worms, it is not surprising that they should have attracted the attention of the early naturalists, by some of whom they were known under the names of Ligniperdæ; and Reaumur and De Geer have entered very fully into their natural history and structure. The former of these authors

(*Mémoires*, tom. iii. Mém. 5.) has described many of the varieties in the cases formed of leaves, twigs, straws, wood, stone, sand, or shells. He has also figured (*Ibid.*, pl. 12, 13.) the transformations of P. striata (according to Linnæus and Pictet), and, in pl. 14. f. 1—4., those of a species which Linnæus quotes as P. grandis, but which appears to agree both in the spirally-arranged case, and the spotted wings of the imago, with the P. varia (*Pictet*, pl. 11. f. 1.). The cases of a minute species are also represented, together with the imago, in the same plate, but too vaguely to be determined; they are probably a minute species of Mystacida; whilst, in the fifteenth plate of the same volume, he has figured the cases of the larvæ of a Mystacida *Latr.*, the hind legs of which are greatly elongated.

De Geer has entered more minutely than Reaumur into the details of the habits and structure of these insects, of which he traced five species through their different states. These are P. pellucida *Oliv.*, *Pictet* (Mém., tom. ii. pl. 11, 12.), P. grandis (pl. 13. f. 1—17.), P. grisea (pl. 13. f. 18—21.), P. fusca? (according to Goëze's edit., vol. ii. p. 442.), and P. bimaculata *Linn.*, which is evidently a Mystacida. He, moreover, figured a variety of cases of different forms, of which he had observed the larvæ, and of which some (pl. 15. f. 15—17.) are of a singular form, being apparently composed of fine sand, of an elongate-ovate shape, with a broad mouth and two protuberances at the opposite extremity. They probably belong to a species of Hydroptila. He, moreover, figured several perfect insects of which he had not observed the larvæ.

Rösel (*Abhandl. von Ins.*, vol. ii., *Ins. Aquat.*, tab. 14—17.) has figured various cases, together with the transformations of three species, which have been cited as P. grandis, striata, and rhombica.

With the exception of Reaumur's figures in his fifteenth plate, above referred to, and those of De Geer's of P. bimaculata (all of which are destitute of sufficient precision in the details), the various larvæ figured by these authors are all referable to one type of form, having the head and three thoracic segments scaly, the legs moderately long, the basal segment of the abdomen furnished with three fleshy protuberances, and the third armed with two short hooks, with the external organs of respiration, consisting of slender soft filaments, arising separately, and lying transversely on the upper and under sides of the abdomen. Such are the characters of the larvæ of the genus Phryganea, as restricted by Pictet. Those of

the genus Mystacida, as above noticed, differ in having the posterior pair of legs greatly elongated; whilst those of Sericostoma have the external organs of respiration short and united on a common base, so as to form small bundles of short filaments. In the larvæ of the Trichostomæ the anterior angles of the thoracic segments are greatly produced in front, forming acute points; and in those of the Hydroptilæ, the thoracic segments are narrow, and the abdomen swollen and destitute of external organs of respiration; these reside in small flattened kidney-shaped cases, opened by a slit at each end (*fig.* 68. 5. case of H. pulchricornis *Pictet*). M. Pictet further notices the interesting circumstance (long ago, however, observed by Willughby, as above detailed), that the larvæ of many of these insects reside in immoveable cases attached to stones, &c., but formed of materials similar to the moveable cases* (*fig.* 68. 6. case of Hydropsyche senex *Pictet: fig.* 68. 8. elongated tortuous fixed cases, composed of silk and fine sand, formed by the larvæ of Hydropsyche maculicornis *Pictet*). These larvæ are therefore compelled to quit their retreats whilst searching for their food in a naked state, and they are accordingly better fitted for such a kind of life, by having the abdomen of a firmer consistence, with stronger anal hooks (*fig.* 68. 18. larva of Hydropsyche atomaria *Pictet*), and the organs of respiration consisting of numerous short bundles (*fig.* 68. 19. gills of the larva of Hydropsyche atomaria *Pictet*, *fig.* 68. 20. gills of the larva of Rhyacophila vulgaris *Pictet*), or entirely wanting. Of these species the pupæ of the genus Hydropsyche are enclosed in a single silky envelope, to which various materials are attached; whilst those which have the pupa enclosed, in addition to this outer case, in another distinct internal cocoon (*fig.* 68. 7. inner cocoon of Rhyacophila vulgaris *Pictet*) spun by the larva, compose the genus Rhyacophila of Pictet.

In those species which are destitute of external gills, the respiration is effected by spiracles placed on each side of each abdominal segment; and species thus circumstanced are placed by Pictet in the same genus with others furnished with external organs of respiration.

From these considerations, M. Pictet has constructed the following

* M. V. Audouin communicated to the Entomological Society of France, on the 9th of January, 1833, a piece of granite, on the surface of which were a number of small rounded eminences, formed of minute granules of quartz, and which were discovered to be the cases of a small species of this family.

table, confirming, in respect to the peculiarities in the preparatory states, the genera founded upon the characters of the imago.

Larvæ enclosed in a moveable case	with a circular opening.	Thoracic segments rounded.	External organs of respiration isolated, legs moderate -		Phryganea.
			External organs of respiration in bundles.	Hind legs long -	Mystacida.
				—— legs short -	Sericostoma.
		Thoracic segments pointed	with the front angles - - -		Trichostoma.
	opening with a slit - - -				Hydroptila.
Larvæ not enclosed in a moveable case.	The pupa enclosed in a double envelope -				Rhyacophila.
	The pupa enclosed in a single envelope -				Hydropsyche.

M. V. Audouin has shown me the case of a small unknown species of this family, quite unlike any hitherto figured, being composed of fine sand cemented together, and saucer-shaped, so that it is difficult to conceive how the larva could employ it as a means of defence or abode.

When the period for assuming the pupa state is arrived, the larvæ, which reside in moveable cases, fasten them to some fixed substance beneath the water, and close the two extremities with an openwork fence, which varies in form in the different species, and which, by admitting a current of water, permits the respiration of the pupa; indeed, Reaumur states, that he actually saw this gratework in alternate motion from convex to concave, as the water passed out and in (*fig.* 67. 12. represents the grating of the case of P. fusca? after De Geer). Within this retreat they then became inactive pupæ, in which they bear a considerable resemblance to the imago, except that the antennæ, palpi, wings, and legs are shorter, enclosed in separate sheaths, and arranged upon the breast (*fig.* 67. 13. pupa of P. pellucida *De Geer*), the antennæ, in the species which have those organs, greatly exceeding the length of the body, being extended beyond the abdomen, with the extremities curled up (*fig.* 67. 17. pupa of Mystacida bimaculata *De Geer*). The front of the head (*fig.* 67. 14. head of pupa of Hydropsyche senex *Pictet*) is moreover furnished with a pair of corneous hooks, but which are the real mandibles, crossing each other, and different in form from those of the larva and pupa, which give the head the appearance of a beak, varying in form and strength in the different groups, according to the nature of the cocoons (*fig.* 67. 15. mandible of pupa of Hydropsyche atomaria *Pictet*). With this the pupa makes its way through the openwork mouth of its case, shortly before assuming the perfect state, at which period it

assumes considerable activity, swimming along, as I have observed, by means of its two hind legs, which are strongly ciliated, and crawling about by means of its four fore legs, which become detached from the breast. M. Pictet has made some interesting observations on the relations of the limbs of the pupa with those of the larva, and of the manner in which the former are enclosed within the larva skin. The pupæ of the larger species creep out of the water, crawling up the stems of plants, &c., and undergoing their final change in the air; but the smaller ones merely come to the surface, where they shed their pupa skin in the same manner as gnats, their old envelope serving them as a raft.

The pupa is furnished, as well as the larva, with external respiratory filaments, besides which, each of the segments of the abdomen, except the first and last (*fig.* 67. 16. second abdominal segment of the pupa of P. striata *Pictet*), is dorsally provided with a pair of small patches, charged with recurved points, which evidently assist the pupa in making its escape from the case, previous to assuming the perfect state. The pupæ of Phryganea have also a row of short filaments at the sides of the abdomen, the uses of which are unknown. The abdomen is also terminated by various appendages, of which the form varies in the different groups. The perfect insects are of small or moderate size, seldom reaching a couple of inches in the expanse of the wings. They are very active, running with agility with a kind of gliding motion, not unlike that of certain Tipulidæ, and other insects with long tibial spurs; but their flight is awkward, except in some of the smaller species, which assemble in troops, and fly over the surface of water towards sunset: they frequent damp marshy situations. From the weak structure of the mouth, it is evident that they can live but a very short time in the perfect state, taking no nourishment, and only anxious to continue their species. Their colours are obscure, being ordinarily brown or grey; when handled, they emit a very disagreeable odour. A very few exotic species are ornamented with spots and markings. Few, only, have been brought from extra-European countries.

This order was first proposed by De Geer (to which his commentator Retzius applied the name of Elinguia), and included the Linnæan Phryganeæ and Ephemeræ, which two groups were also united by Dumeril into his family Buccélés or Agnathes. Linnæus had united the Perlidæ and Phryganeæ into one genus, from the characters

of the imago, such as the folded wings, &c., which plan was also adopted by Lamarck. Mr. Kirby, in the 11th volume of the *Linn. Trans.*, and subsequently Leach, restricted it to the genus Phryganea of De Geer, of which the leading characters are given above; whilst Latreille retained the family as a distinct section of the order Neuroptera, under the name of Plicipennes; in this respect he has been followed by M. Pictet, who has substituted the name Phryganides. Mr. MacLeay, in the *Horæ Entomologicæ*, from an erroneous idea relative to the larvæ of the Perlidæ, considered that family as belonging to the same order as the Trichoptera, the inaccuracy of which has been commented upon in a preceding page; but Mr. MacLeay proceeded on this false foundation to show that, as the organisation of the perfect Perlidæ and Phryganeæ is so variable, (whilst he considered the larvæ to be all cylindrical, with membranaceous feet, and to undergo the metamorphosis obtecta* *Linn.*,) it would be difficult to exclude the Tenthredinidæ from the order (*Horæ Entomol.*, p. 431.), which he accordingly divided into three stirpes, Perlina, Phryganina, and Tenthredina.† The introduction of the Perlidæ into the order, which was Mr. MacLeay's ground for the admission of the Tenthredinidæ, having been already shown to be untenable, will render it unnecessary for me to enter into any arguments against reinstating the Tenthredinidæ in the order Hymenoptera, especially as Mr. Kirby has completely answered Mr. MacLeay's objections in the *Introduction to Entomology*, vol. iv. p. 374. That there may be a slight relation between the Trichoptera and Tenthredinidæ ‡ may be admitted, but it appears to me that the genus Phryganea forms the connecting link between the Neuroptera and Lepidoptera. That it is closely related to the Neuroptera will be evident, because Latreille, Pictet, and others still consider Phryganea as Neuropterous, being especially related to the genus Sialis, which seems to form the passage between the Phryganeæ and Perlidæ; but not only are the veins of the wings arranged upon the plan of the Lepidopterous wings, the general habit of the insects,

* Neither the Perlidæ, Phryganeidæ, nor Tenthredinidæ undergo obtected metamorphosis, as assumed by Mr. MacLeay.

† Mr. MacLeay (*Horæ Ent.*, p. 432.) mentioned a terrestrial larva, inhabiting a case, found in Java by Dr. Horsfield, and which he considered to be that of a terrestrial Trichopterous insect. It is, however, clearly the larva of a Lepidopterous insect, allied to Oiketicus of Guilding and to the Sacktragers of the Germans (Psyche, &c.).

‡ Latreille introduces the Phryganeæ between the Neuroptera and Hymenoptera.

the structure of the legs, coxæ, calcaria, and mandibles, as noticed by Kirby, and, indeed, the general rudimental form of the mouth being similar; and, what is more important, the internal structure of the larvæ, as noticed by De Geer, agrees with that of the Lepidopterous larvæ rather than with the Neuroptera. There are many Tineidæ, the larvæ of which reside in cases somewhat similar to those of the Phryganeæ, whilst the long-horned Japan moths (Adelæ) seem to present a near relation to the Mystacidæ of Latreille (Leptoceri *Leach*). Mr. Newman, (Sphinx Vespiformis, table opp. p. 21.), has even introduced the Lepidopterous genus Psyche into the order Neuroptera, in which he also includes the Trichoptera.

Until very recently, but little attention had been paid to these insects. Dr. Leach, indeed, studied them carefully, and announced a distinct work upon the subject, but which he never completed. Subsequently, Mr. Curtis published the descriptions of various species in the *Philosophical Magazine* (new ser. Feb., March, 1834), but the most valuable work upon the group is that by M. Pictet of Geneva, upon the Phryganeæ of Switzerland. In this admirable memoir, the natural habits, anatomical and physiological characters, transformations and specific differences, of a great number of species have been recorded, and which, from a consideration of their characters, both in the preparatory and perfect states, he is induced to arrange into seven genera alone.

Whilst the entire number of species collected from various sources by Olivier (*Encycl. Méth.*, tom. vi.) amounted only to 77, M. Pictet detected, in Switzerland, nearly 120 species, of which he had noticed the preparatory states of not fewer than 52, whereas seven only had been previously observed in their earlier stages by De Geer, &c., as above mentioned. It is to be regretted that the figures of the species in the imago state, are, in the majority of cases, completely unrecognisable, whilst the peculiarities in the veinings of the wings are too much overlooked. Shortly afterwards, Mr. Stephens described nearly 190 British species in his *Illustrations*, which he divided into eight families, corresponding with seven of Pictet's genera, to which he added another anomalous family, Acentropidæ, which, in my opinion, belongs to the order Lepidoptera. The other families, Hydroptilidæ, Rhacophilidæ, Hydropsychidæ, Sericostomidæ, Psychomidæ, Leptoceridæ (Mystacida, *Latr.*), and Phryganidæ, he divided into numerous genera, founded, like those of Mr. Curtis, established in the *Philosophical Magazine*, upon the neuration of the wings, and the

variations in the tibial spurs. I shall, however, regard these groups as sub-families, constituting one great family Phryganeidæ, and of which the following tabular characters will show the chief distinctions.

1. Antennæ filiform, or pectinated; hind wings not folded. [Hydroptilides.]
2. Antennæ setaceous.
   i. Hind wings not folded. [Psychomyides.]
   ii. Hind wings folded.
      A. Without transverse nerves in the wings.
         a. Maxillary palpi dilated in the males. [Sericostomides.]
         b. Maxillary palpi alike in both sexes.
            α. Terminal joint ovoid. [Rhyacophilides.]
            β. Terminal joint filiform, very long. [Hydropsychides.]
      B. With transverse nerves in the wings; terminal joint of maxillary palpi ovoid.
         a. Maxillary palpi very long, very pilose, 5-jointed in both sexes. [Leptocerides.]
         b. Maxillary palpi moderate, slightly pilose, 4-jointed in the males. [Phryganeides.]

ORDER HYMENOPTERA* *Linn.*

(GYMNOPTERA *Linn.* olim; GEOFFROY-GYMNOPTERA *Scop.*; PIEZATA *Fabr.*; PHLEBOPTERA *Clairv.*)

CHAR. Wings four, naked, membranous; the posterior pair smaller than the anterior, with comparatively few veins.

Mouth with horny jaws, and with a lower lip or tongue, sheathed by the maxillæ.

Tarsi generally 5-jointed.

Abdomen armed with a multivalve saw ovipositor, or sting, in the females.

Larva apod and vermiform (or eruciform and pedate in one group).

Pupa incomplete and inactive.

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If interesting habits and economy, great development of instinctive powers and social qualities, be considered as indicating superiority in their possessors, the insects composing the order Hymenoptera have certainly far greater claims to be placed in the foremost ranks of the insect tribes than any of their brethren. The bee, the wasp, the ant, the saw-fly, the gall-fly, and the ichneumon-fly, all belonging to this order, have attracted the attention of the observer of nature from the earliest period.

As an order, these insects are distinguished by the number, comparative size and structure of the wings, the mandibulated mouth, enclosing a labium ensheathed by the maxillæ, the ovipositor, or sting, with which the females are provided, and the nature of their metamorphoses.

The eyes are generally large and lateral, occasionally occupying, in the males of certain groups, the greatest portion of the head: they

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Westwood, in Proceedings of Zool. Soc., April and May, 1835; and the general works of *Linnæus, Fabricius, De Geer, Rossi* (ditto edit. by Illiger), *Olivier* (Encycl. Méth.), *Walckenaer, Panzer, Schrank, Klug, Curtis, Stephens.*

are generally accompanied by three minute simple ocelli, placed in a triangle, or curved line, upon the crown of the head. M. Dufour has described a species of Anoplius (Fam. Pompilidæ), having only a single ocellus (*Ann. Soc. Ent. de France*, tom. ii. p. 484.); and in the apterous females of certain genera they are entirely wanting. In a very few species, the eyes themselves appear also to be entirely wanting.

The antennæ are very variable in structure in the different groups; those of the males are generally much more developed than in the other sex, and often furnished with various appendages. The number of the joints varies very greatly in the aberrant tribes, or those furnished with an ovipositor; but, in the typical aculeate division, these organs are filiform, or setaceous and simple, and almost uniformly composed of thirteen joints in the males, and twelve in the females.

The mouth is composed of a membranous or leathery labrum; a pair of horny mandibles, a pair of long membranous or leathery maxillæ, each provided with an articulated palpus, varying in the number of its joints from one to six; and a lower lip, or tongue, having a basal mentum; lateral palpi, also varying in the number of their joints from one to four, and occasionally with slender filaments, or paraglossæ: this organ varies in length according to the size of the maxillæ, in the motions of which it participates. In many species the mandibles cannot be regarded as organs of manducation, being employed solely in the construction of the nest; the maxillæ, also, are unfitted for mastication, uniting with the lower lip and its appendages, to which they form a kind of sheath, and forming an elongated rostrum, of very complex construction, by which they collect their food, which consists of honey, and forming a passage to the entrance of the alimentary canal. This latter character may, indeed, as St. Fargeau suggests (*Hist. Nat. Ins. Hymén.*, tom. i. p. 80.), be regarded as the most distinguishing trait of the order.

The body of these insects is covered with a hard scaly integument, the three portions of which it is composed being ordinarily distinct from each other.

The head is attached to the thorax by the narrowed part of the prothorax; it is generally transverse, and narrower than the thorax.

The thorax generally forms an oval mass; the prothorax, to which the fore legs are attached, is of very small size, owing to the necessarily increased development of the other thoracic segments supporting

the wings; the only portion visible from above (except in a few species, which have an elongated neck, as Xiphydria, &c.) being the part which is usually termed the collar, having its posterior margin arched, and sometimes extending to the base of the fore wings, and forming the front of the upper portion of the thorax. It is, however, so much detached from the remainder of the prothorax, that Mr. Kirby considered it as not belonging thereto, but as an organ, *sui generis;* Messrs. MacLeay and Audouin, however, agree in regarding it as a portion of the prothorax, although they differ as to its exact analogue. (Consult Kirby and Spence, *Introd.*, vol. iii. p. 549., MacLeay's Memoir in the eighteenth number of the *Zool. Journ.*, Audouin's translation thereof, with additional notes, in the *Ann. des Sciences Natur.*, tom. xxv., Haliday, in *Entomol. Mag.*, vol. v. p. 212., and Burmeister's *Manual*, English edition, p. 78.) The two other thoracic segments are united into a mass; the mesothorax, from bearing the largest pair of wings, being more extensively developed than the metathorax, and bearing on its upper surface a conspicuous plate, which is the mesothoracic scutellum; and at the base of the fore wings is a pair of small corneous pieces, termed tegulæ. According, however, to Audouin and Latreille, the terminal portion of the thorax, in which a pair of lateral spiracles is observable, is the real representative of the basal segment of the abdomen (in those species which have the abdomen pedunculated); the metathorax itself being supposed to be reduced, above, to a narrow arch, whilst the first apparent segment of the abdomen, forming the peduncle in certain groups, is, in effect, the second abdominal segment. Messrs. Kirby, MacLeay, Saint Fargeau, and Burmeister, however, consider this spiracle-bearing portion as the termination of the metathorax; and I have clearly shown, in a memoir upon the anatomy of the earwig, published in the *Transactions of the Entomological Society*, vol. i., that the metathorax is provided with a pair of spiracles.* In a memoir, published in the twenty-fifth number of the *Entomological Magazine*, I have also endeavoured to prove that the hind part of the thorax in the petiolated Hymenoptera, cannot be regarded as abdominal; and, in a subsequent page, under the

* Consult Latreille (*Fam. Nat.*, p. 259.), Cuvier (*Rapport*, on Audouin's *Mémoire*, p. 11.), MacLeay, (in *Zool. Journ.*, No. 18.), Audouin (in *Ann. Soc. Nat.*, tom. xxv.), Burmeister (*Manual*, p. 85.), Saint Fargeau (*Hist. Nat. Ins. Hymén.*, tom. i. p. 78.).

family Tenthredinidæ, I have entered into the same subject, as regards the species which have the abdomen sessile.

The wings are four in number; they are naked, membranous, and horizontal, the anterior pair being much larger than the posterior, with a scaly plate (tegula *Latr.*) at the base of the former; they are moreover furnished with corneous nerves, or, more properly speaking, veins arranged longitudinally and transversely, but much fewer in number than in the Neuroptera, so that they do not form a close network, as in the latter order; the spaces, or areas, enclosed between these nerves are of various sizes, and are termed cells, and which are of great service in the investigation of the inferior groups and genera, as first pointed out by Moses Harris, in his *Exposition of English Insects*, published in 1782, and subsequently more fully developed by Jurine, in his *Nouvelle Méthode de classer les Hyménoptères, &c.* (4to. 1807).* The anterior wings are also furnished with an incrassated spot, termed the stigma, near the extremity of the anterior margin, from which proceeds a nerve of a curved form, running towards the tip of the wing, and enclosing one or two cells, termed marginal or radial; below, and running nearly parallel with this curved nerve, is another, connected therewith by transverse nerves, enclosing several cells, termed the submarginal or cubital. The number of these nerves is, however, liable to considerable reduction, the wings being almost, and even entirely, destitute of nerves in some of the minute species, constituting the families Chalcididæ and Proctotrupidæ.

Another character of the order consists in the connexion, during flight, of the two wings on each side of the body, by means of a series of minute hooks along the anterior margin of posterior wings, which

* More recently, Jurine, in the 24th volume of the *Memoirs of the Academy of Turin*, Saint Fargeau (*Hist. Nat. Hyménopt.*, p. 46—69.), Shuckard, in a memoir published in the first volume of the *Transactions of the Entomol. Soc. of London*, and in his work on the *British Fossorial Hymenoptera*, Gravenhorst (*Ichneumonologia Europæa*, vol. vi. plate 1.), Haliday (*Entomol. Mag.*, vol. v. p. 211.), Professor Wesmael (*Monogr. Braconides de Belgique*, pl. 1.), and Dr. Th. Hartig (*Die Aderfl. Deutchsl.*, pl. 7. fig. 1.) have respectively examined in great detail the composition of the wings of the Hymenoptera, applying distinct names to the different cells and to each vein. But as the nature of the wing-ribs is now clearly ascertained to be that of veins, it appears to me that a more natural mode of treating them than has hitherto been proposed must be based upon the relation of the different minor veins with those which are employed in the greater ascending and descending currents.

catch the hinder margin of the anterior wings, thus producing one continuous surface on each side.

The legs are generally long and slender, and the tarsi (except in a few minute species, — Eulophus,) are 5-jointed. In the females of many fossorial species the anterior tibiæ and tarsi are furnished with strong lateral bristles, useful in clearing away the sand in nidification; and, in the bees, the basal joint of the tarsi is greatly increased in size: these and other modifications of form are consequent upon diversity of economy.

The abdomen is very variable in the number of its segments, especially in the Terebrantia. In the Aculeata it is, for the most part, composed of seven segments in the males, and six in the females. Its form is also very various; in some species being sessile or attached to the posterior part of the thorax by its entire breadth, and, in others, being connected therewith by a more or less slender peduncle. In the females this part of the body is furnished with an instrument consisting of five or six valves, or setæ. Although the various uses to which this instrument is applied, in the different groups, as a borer, saw, or venomous sting, require correspondent modifications in structure, yet it appears to me that a typical formation is to be traced throughout the various forms under which it appears; it is defended externally by a pair of lateral flattened plates, articulated near the centre, or, rather, near the point where they emerge from the anal cavity, the edges being externally applied closely together, forming a sheath for the protection of the internal organs, which consist of a pair of darts, or retroserrated spiculæ, which are alternately thrust forward and withdrawn, being themselves enclosed in an internal sheath. In the aculeated tribes, the latter, enclosing the two spiculæ, constitutes the sting, but they are so fine that they appear to the naked eye to consist but of a single piece, the articulated sheaths being internal. In the Ichneumons with exserted ovipositors, the two sheaths are equally exserted, constituting the two sheaths of the ovipositor itself, which, although appearing like a simple bristle, is formed like the sting of the bees, &c. In the saw-flies, the spiculæ are broad, serving as saws, the internal sheath being also flattened and divided along its whole length into two portions, forming supports, like the thickened backs of the ordinary hand-saw to the saws themselves. The outer sheaths are distinct and broad, the saws lodging between them when unemployed. Saint Fargeau regards the ovipositor, or oviscapte, as he terms it, and the

sting as distinct instruments, and stating that there is a tribe which possesses both organs. (*Hist. Nat. Hyménopt.*, p. 80.) I cannot but think, however, that there must be some mistake in this assertion. Burmeister has given another and apparently incorrect view of the analogous structure of this organ. (*Manual of Entomol.*, p. 198.)

Exceptions, of course, exist to almost all the characters of the order: thus, apterous insects are found in the families Formicidæ, Mutillidæ, Chalcididæ, Cynipidæ, &c. Some ants are destitute of mandibles; others do not possess an aculeus; and some do not appear to possess the least trace of organs of sight.

The Hymenoptera undergo that species of metamorphosis which has been termed incomplete, the pupa itself being incomplete; the larvæ, in the majority, are vermiform and footless; the mouth in these is but slightly developed. In the saw-flies, however, the larvæ resemble the caterpillars of Lepidoptera, having a scaly head and six scaly feet, and numerous fleshy prolegs, and the mouth is also strongly mandibulated; the mandibles, maxillæ, and lips, being distinct and of a moderate size; the extremity of the under lip is also furnished with a spinneret, for the discharge of the silken threads employed in the construction of the cocoon. The larvæ of the saw-flies feed upon leaves, and those of the Siricidæ upon wood; but those of the remainder of the order being destitute of legs, are indebted to the instinctive care of the parent fly, which deposits her eggs in those situations where the future grubs will be certain of an ample supply of food, either in the interior of the bodies of other insects (as in the Ichneumons, &c.), or by feeding upon insects which have been captured and deposited with the eggs (as in the Fossores), or by devouring the substance of vegetable galls raised by the irritating matter deposited by the female at the time of oviposition, (as in the Cynipidæ), or lastly, by feeding upon vegetable matter, as pollen paste, deposited with the egg, in curiously constructed nests, as in many bees. The larvæ of the ants, however, as well as of some species of bees, and other social species, are tended and fed by the perfect neuter insects, with as great care as though they were their own offspring. When arrived at their full growth, and after undergoing several previous moultings, these larvæ are transformed into inactive pupæ, in which all the limbs of the future insect are observable, encased in distinct sheaths, and folded upon the breast. In some small species of the order, chiefly belonging to the family Chalcididæ, the limbs are so firmly arranged together, that the pupa has the appear-

ance of an obtected (Lepidopterous) chrysalis. Dr. F. T. C. Ratzeburg has published a memoir in the *Nova Acta Natur. Curios.* (tom. xvi. 1832), entitled *Uber Entwickelung der Fusslosen Hymenopteren larven mit besonderer rucksicht auf die gattung Formica,* the chief object of which is to prove that the first segment of the body, as well as the head of the apodal larva, corresponds with the head of the pupa; that the fourth segment of the body (exclusive of the head) corresponds with the metathorax, and the fifth segment with the abdominal peduncle. Ratzeburg appears to have arrived at this conclusion from having noticed that, in the larva immediately preceding the change to the pupa state, the eyes of the pupa appear visible through the slender skin of the second segment (inclusive of the head), and that the fifth and sixth segments are contracted. This view of the subject is so completely at variance with what is observed in other, pedate larvæ, in which it is certain that the head of the larva corresponds with the head of the pupa and imago, and the circumstances noticed by Ratzeburg are so easily accounted for upon considering the necessary increased size of the head of the enclosed pupa over that of the larva, that I do not hesitate to consider these views as untenable, as I have more fully endeavoured to prove in a memoir upon this subject, published in the *Transactions of the Entomological Society* (vol. ii. p. 121.).

On arriving at the perfect state, these insects, for the most part, take but little nourishment, and this almost exclusively consists of the nectar of flowers. Many species, indeed, especially belonging to the family of the bees, may be observed, from morning till night, busy in the flowers; they are, however, occupied in collecting pollen and honey for the stores of their future progeny, rather than providing food for themselves; and the same remark may be made respecting the ferocious Fossores, which may be observed dragging along the dead bodies of other insects, which they themselves do not devour. The wasps and ants are certainly more or less carnivorous; but the havoc which these insects make in our wall-fruit prove that they are equally partial to vegetable matter; and cells filled with honey have been observed in the nests of some Polistides, having even been found by M. Aug. Saint Hilaire in the nests of the Brazilian P. licheguana, a very venomous species. The affection which the ants bear to the Aphides having for its object the obtaining a supply of the saccharine fluid emitted by the latter, called honey dew, is also a proof of the

same fact. Hence, the various forms observable in the structure of the mouth of these insects, notwithstanding the uniformity of the nature of their food, are dependent upon the form of the flowers from which the nectar is procured; the means by which it is prepared and transported either for food or for store for the future young; and the various modes in which the different parts of the mouth are employed in the construction of the nests. For instance, if a flower be long and tubular, it is necessary that the tongue should be elongated and slender; whereas in those species which collect the honey from shallow or flat flowers, the tongue is shortened. In those species, again, which collect honey for store for their young, the tongue and its appendages are of large size; whereas in those which need only a very small supply of honey for their own support, it is short and narrow. The form of the mandibles, again, is entirely dependent upon the mode of construction of the nest, serving as trowels, rasps, &c. The order is also anomalous, from comprising species which are composed of three kinds of individuals, namely, males, females, and neuters. The latter occur in no other order of insects except in the single Neuropterous family Termitidæ; and as they exist only in the social species, where a great share of the labour of the community is cast upon a certain portion of the inhabitants, it is necessary for the due performance of the labour by the latter, that they should not interfere with the duties of the individuals occupied in continuing the race; and their sexual organs and instincts are accordingly rendered singularly abortive. In all other respects they are females. These peculiarities will however more properly obtain notice under the respective families. The duration of the existence of these insects never exceeds one year, there being only one generation during that period.

This order is of very considerable extent, being apparently inferior only to the Coleoptera. Messrs. Kirby and Spence have estimated the number of its species as averaging about one fourth of the insect population. In this country we probably possess 3000 species, of which two thirds are of minute size. These insects, judging at least from the number of large species sent home by travellers, appear to be far more abundant in tropical climates than in our country. The species seldom occur of a very large size, very few attaining or exceeding two inches in length, or three in the expansion of the wings.

Messrs. Kirby and Spence seem to consider that, in respect to the mode of taking their food, the Hymenoptera can belong to neither of

the great divisions Mandibulata and Haustellata, but that they really lap their food, and might thence be termed lappers, their mandibles being employed in their economy. Dumeril however, (*Considérat. Général.*, p. 9.), gives them "la double faculté" of masticating and sucking the food, considering the lower organs of the mouth as forming "une sorte de tube et de langue." Hence Lamarck makes the Hymenoptera the connecting order between the Mandibulata and Haustellata. Latreille, attaching greater importance to the organs of flight than to the mouth, has placed the Hymenoptera between the Neuroptera and Lepidoptera, regarding Phryganea and Termes as forming the passage between the two former orders and the long-tongued bees as approaching the Lepidoptera. (*Considérat. Général.*, p. 73. 76.). Another circumstance, confirming the relationship with the last-named order, occurs in the resemblance between the larvæ of the Saw-flies and the caterpillars of the Lepidoptera.

Mr. MacLeay, on the other hand, places the Hymenoptera between the Coleoptera (with which they are supposed to be connected by the osculant order Strepsiptera), and the Trichoptera, the Tenthredinidæ being considered as Trichopterous, and the Uroceridæ as forming an osculant order, Bomboptera, between the Trichoptera and Hymenoptera, which last order is thus reduced to the species possessing apodal larvæ; thus, by means of the connection between the Ants (Formicidæ), and White Ants (Termitidæ); and the Caddice-flies (Phryganeidæ), and Saw-flies (Tenthredinidæ), a strong relation is shown to exist between the Linnæan orders Hymenoptera and Neuroptera.

It seems to be admitted on all hands that the insects, which are the real analogues of the present order, exist in the Dipterous order, almost every Hymenopterous group having its representative in the latter. Mr. MacLeay has also noticed the apodal structure of the larvæ as analogous in both orders, adding also the incomplete or coarctate nature of the metamorphosis: no Hymenopterous insect, however, undergoes the latter kind of transformation.

The order was established by Linnæus under the name of Gymnoptera (naked wings), in the 4th edition of the *Systema Naturæ* (1744); it had previously, by the old naturalists, been united with the Neuroptera. In this edition, as well as in the 1st edition of his *Fauna Suecica* (in which work the name of the order was changed to Hymenoptera), it was composed of only four genera, Tenthredo, Ichneumon, Apis, and Formica; but in the subsequent writings of the il-

lustrious Swede, the genera Cynips and Urocerus were separated from Tenthredo; Sphex, Chrysis, and Vespa from Apis, and Mutilla from Formica. In his last edition of the *Systema Naturæ*, 314 Hymenopterous species were described; but in Gmelin's 13th edition of this work, their numbers were increased to 1241. Other genera were added by Geoffroy, Fabricius, Panzer, &c., but the first attempt to distribute these generic groups into primary sections was successfully made by Latreille, who divided the order into, 1st. The Terebrantia; and, 2d. The Aculeata;* the former including the Saw-flies (Securifera), and the Cuckoo-flies (Pupivora); and the latter comprising the Ants (Heterogyna), Sandwasps (Fossores), Wasps (Diploptera), and Bees (Mellifera). In the Terebrantia the construction of the abdomen and ovipositor and the antennæ offer the most satisfactory characters for classification, but which become almost useless from their uniform structure amongst the Aculeata; resource is therefore had, in the latter section, to the wings, the habits of the insects, and the nature of the food of the larvæ, &c.

Mr. MacLeay, excluding Tenthredo and Urocerus from the order, divides it into five groups: — 1. Anthophila (Bees), connected by the Wasps (the folding of the wings of which does not appear to him to be a character of so much importance as it possesses in Latreille's system), with 2. Rapacia (Sand-wasps); 3. Pupivora (Cuckoo-flies, &c.); 4. Heterogyna (Ants); and 5. Tubulifera (Ruby-tails). The removal of the Ants (and Mutillæ), from their intimate allies the Anthophila and Rapacia, to a situation between the parasitic Pupivora and Tubulifera, cannot be maintained. In like manner, and for the reasons given by Messrs. Kirby and Spence (*Introduct.*, vol. iv., p. 374.), and upon other considerations which I have detailed in my volume upon Insects in the *Cabinet Cyclopædia* of Dr. Lardner, I do not adopt Mr. MacLeay's removal of the Tenthredinidæ and Uroceridæ; and therefore propose the following arrangement, founded chiefly upon the views of Latreille:—

Sect. I. TEREBRANTIA, *Latreille*, (Hymenoptera Aberrantia), exhibiting very variable structure, but having the abdomen of the females furnished with an instrument employed as a saw or borer for depositing the eggs. Antennæ various.

Sub-section 1. PHYTIPHAGA, SESSILIVENTRES, SECURIFERA, or

* It may be noticed that Linnæus thought of dividing the Hymenoptera into two sections, "secundum aculeum punctorium vel mitem." (*Philos. Entomol.*, 4to., p. 29.)

SERRIFERA, having the abdomen sessile, the larvæ feeding upon vegetable matter, with a well developed mandibulated mouth. Fam. 1. *Tenthredinidæ*. 2. *Uroceridæ*.

Sub-section 2. ENTOMOPHAGA (Pupivora *Latr.*), having the abdomen attached to the thorax by a portion only of its transverse diameter: larvæ with slightly developed mandibulated trophi, for the most part feeding parasitically upon other living insects.

Division 1. SPICULIFERA, abdomen with an elongate plurivalve oviduct: larvæ for the most part feeding parasitically upon other living insects. Fam. 3. *Cynipidæ*. 4. *Evaniidæ*. 5. *Ichneumonidæ*. 6. *Chalcididæ*. 7. *Proctotrupidæ*.

Division 2. TUBULIFERA, *Latr.* Extremity of abdomen tubular, retractile, and furnished with a minute sting. Larvæ feeding upon the larvæ of other Hymenoptera, or upon dead insects deposited by the parents of such larvæ for the support of the latter. Fam. 8. *Chrysididæ*.

Sect. II. ACULEATA, *Latreille* (Hymenoptera Normalia, or the typical portion of the order), the abdomen of the females (and neuters), armed with a sting connected with a poison reservoir. Antennæ of the males, 13-; females, 12-jointed.

Sub-section 1. PRÆDONES, *Latr.* (Heterogyna, Fossores, and Diploptera, *Latr.*) having the basal joint of the posterior tarsi cylindrical, not dilated, nor formed for collecting pollen: larvæ feeding upon other insects stored up, or upon animal or vegetable fluids provided by neuters. Fam. 9. *Crabronidæ*, 10. *Larridæ*, 11. *Bembecidæ*, 12. *Sphegidæ*, 13. *Scoliidæ*, 14. *Mutillidæ* 15. *Formicidæ*, 16. *Vespidæ*.

Sub-section 2. MELLIFERA, *Latr.*, having the basal joint of the posterior tarsi dilated and pollinigerous. Larvæ feeding upon honey or pollen paste, deposited by the parent, or collected by neuters. Fam. 17. *Andrenidæ*, 18. *Apidæ*.

A succession of affinities appears to exist amongst these families. The bees, which are the most perfectly organised and typical insects of the order, lead to the Vespidæ by means of such short-tongued bees as Hylæus, &c.; whilst the transition from the wasps by the solitary species (Odynerus, &c.) to the Crabronidæ, Sphegidæ, Bembecidæ, Scoliidæ, and Mutillidæ, is almost unbroken. The ants are of difficult location. Their introduction immediately preceding the

wasps, according to the views of Latreille (*Genera Crustaceorum, &c.*, vol. iii. p. 220.), interrupts the series founded upon the great resemblance between such genera as Philanthus and Vespa (Latr. *Consid. Générales*, p. 76.), and upon the fossorial habits of certain Vespidæ; whilst, by placing the ants at the head of the Prædones, as in the later works of the same author, they are far removed from the social bees and wasps with which they agree in their entire economy. I have adopted the former situation for this family, although I cannot but think it would violate fewer relationships were the ants to terminate the order; their supposed affinity with the Mutillidæ would, indeed, in this view be broken; but the relation between these two families is in reality very slight. By this means the series above-mentioned would be maintained, and the connection existing between the aberrant Chrysididæ and certain Fossores, as evinced by their habits, maintained. In the construction of the ovipositor, as well as in the nervures of the wings, some Chrysididæ nearly approach the Proctotrupidæ, especially certain splendid exotic species which I have seen in the Royal Museum of Berlin, allied to Bethyllus*; the genus Stephanus seems to connect the Ichneumonidæ and Evaniidæ, which latter are regarded by Latreille as nearly related to the Uroceridæ. The Cynipidæ appear to me however, in their gall-forming and consequent herbivorous habits, to approach nearer to the Tenthredinidæ, some of which are similarly gall-formers. In the structure of the ovipositor they also approach Oryssus amongst the Uroceridæ, whilst in the parasitic habits of several recently observed species (Allotria victrix, *Westw.*, *&c.*) they are closely connected with some of the minute Adscitous Ichneumons, especially Aphidius, &c. The Uroceridæ, in the structure both of the ovipositor and larvæ, admirably intervene between the Entomophaga and Tenthredinidæ; which last are certainly farther removed from the types of the order than any other of the Hymenoptera.†

* The genus Bethyllus seems to be nearly allied to certain Tiphiæ. Mr. Haliday even seems to regard it as aculeate, and as closely connected with Stigmus; from his account of its habits it also appears to be fossorial.

† By reversing the groups composing the section Aculeata, as arranged above, the bees, which are certainly the types of the order, would be removed to the greatest distance from the adjacent orders of Trichoptera (with which the saw-flies from the connecting link) and Coleoptera (with which some species of ants, according to Mr. MacLeay, form the connection). By this means, however, the circular succession would be prevented, the ants and saw-flies having no bond of union.

It remains shortly to notice the arrangements recently proposed by Stephens, Saint Fargeau, Dahlbom, and Hartig; the three last of whom have devoted almost exclusive attention to this order. The arrangement of Mr. Stephens agrees with that given above, except that a third section (inappropriately termed Tubulifera) is formed of the families Chrysididæ, Chalcididæ, Proctotrupidæ, and Cynipidæ, and placed after the bees. In adopting this plan, Mr. Stephens was doubtless influenced by the remarks of Mr. MacLeay upon the supposed affinities between the Chrysididæ and some splendid foreign bees, and between the Chalcididæ and the order Strepsiptera, which Mr. Stephens places immediately after the Hymenoptera. The removal of the Cynipidæ, Chalcididæ, &c., from the Ichneumonidæ, is clearly unnatural, as well as the juxtaposition of the latter and the ants.

The views of M. Saint Fargeau, as developed in various articles in the *Encyclopédie Méthodique, Magasin de Zoologie, Annales de la Société Entomol. de France*, and more especially in his *Hist. Natur. des Hyménoptères*, are highly interesting, being the result of a scrupulous examination of "toutes les parties des corps de l' Hyménoptère adulte, *dont la forme est l'expression de ses habitudes morales* et mème de sa vie sous la forme de larve" (*Hist. Nat. Hym.* p. 89.). The adoption of these views has necessarily required a minute inquiry into the habits of the various groups, and an equally careful examination of the variations of structure dependent thereupon; and its effects are perceived in the arrangement of the families. The order is divided into two sub-orders, corresponding with the two primary sections given above, but to which the names of Hyménoptères Ovitithers (or Aculeata), and Oviscapters (or Terebrantia) are applied, in allusion to the mode of depositing the eggs. In the former there is said to be no exterior elongation of the oviduct, the eggs passing from the aperture of this organ into an anal cavity*, which opens horizontally, and discharges the egg near the food prepared for the future larva, the female being moreover armed with a sting. In the Oviscapters the eggs are introduced into the interior of various bodies, and it is necessary therefore that the oviduct should

* Figured by Reaumur (*Mém.* tom. v. pl. 29. fig. 1.). This figure is at variance with the more elaborate figures of Swammerdam (pl. 18 and 19.); hence, as well as from the slight degree of attention hitherto bestowed upon the mode in which the egg is discharged in these tribes, I feel inclined to regard Saint Fargeau's definition with distrust.

be externally prolonged for this purpose; which external elongation is named the oviscapt. The sub-order, Ovitithers, is divided into Phytiphages (the larvæ of which feed upon vegetable fluids), and Zoophages (the larvæ of which feed upon other insects, larvæ, or spiders). The Phytiphages are divided into either Nidifians (nest-makers), or parasites. The Nidifians are divided into the social and solitary species, and the social species into those whose communities exist several years, and those which are annual.

The Phytiphagous, nest-making, social, perennial, Ovitithers, comprise the family of the Ants, and the two genera Apis and Melipona. The genus Bombus, and the family Polistides (including Vespa, Polistes, Epipone, and some new genera of social wasps) are annual. So far only have the details of this system been developed. That this view of the subject is highly interesting; and likely to lead, when fully worked out, to important results in the classification of the order, cannot be doubted. At the same time when we see by this mode of arrangement, insects widely separated, which are most intimately allied in general structure, although varying in the form of those particular organs which are employed in constructing a nest—when, for instance, Psithyrus and Euglossa are removed far from Bombus, Odynerus from Polistes, &c., we cannot, as it seems to me, but question whether too great an importance has not been bestowed upon the "habitudes morales" of these insects. I have, however, elsewhere entered more fully into this question (*Brit. Cycl.* vol. ii. p. 874.), and shall only add that, in many cases, as for instance in Psithyrus, Nomada, Ceropales, &c., the parasites, as they are not quite correctly termed, merely deposit their eggs in the already provisioned nests of other insects, and that the progeny of the intruder being first hatched, consume the food stored up for the real inhabitant. There is, therefore, no real difference between the constitution and more important organisms of these miscalled parasites and the species upon which they are parasitic. It is therefore as absurd to place them apart, as it would be to separate the cuckoo, as a distinct primary division, from other birds.

Dr. Dahlbom, a most assiduous Swedish Hymenopterologist, has recently published a very interesting sketch of the distribution of this order in his *Clavis Novi Hymenopterorum Systematis* (Lundæ, 1835, 4to.). He considers the fossorial Hymenoptera as the analogues of the Mammalian Primates, on account of the very imperfect or undeveloped

state of the young and the great activity of the predaceous imago, whilst the herbivorous Tenthredinidæ, from their more perfectly organised and active larvæ and sluggish imago, appear to represent the Pecora at the end of the order. He considers the order as containing four principal divisions, which, from their habits, he names Raptatoria, Parasitica, Ædificatoria, and Plantivora, each being connected with the other three by means of transition groups.

His more detailed view of the distribution of the families "anatomia externa, metamorphosi moribusque simul consideratis," does not appear to be quite in accordance with the quaternary division mentioned above, being evidently artificially constructed, as appears from the numbers attached to the families. The following is a concise abstract of it:—

I. Imago with petiolated abdomen. Larvæ apod, subvermiform.
  A. Imago predaceous, aculeate, solitary, fossorial. Larvæ insectivorous, or erucivorous.
    Fam. 1. Pompilini, 3. Mellinii, 7. Bembicini, 5. Pemphredonides, 4. Sphegides, 2. Larrates, 6. Crabronides.
  B. Imago styliferous, tubuliferous or aculeated, solitary. Larvæ erucivorous, or pupivorous.
    Fam. 8. Ichneumonides, 9. Braconides, 10. Evanialcs, 20. Masarides, 13. Psilides, 14. Tiphiales, 21. Nomadini, 11. Pteromalini, 18. Eumenides, 12. Chrysidides, 17. Sapygini, 15. Mutillariæ.
  C. Imago nest-building, living in society. Larvæ omnivorous.
    Fam. 19. Vespariæ (sociales), 15. Formicariæ.
  D. Imago nest-building, solitary or social. Larvæ mellivorous.
    Fam. 22. Andrenides, 23. Anthophorini, 24. Apiariæ (sociales).
  E. Imago living in galls, with the abdomen compressed. Larvæ feeding on galls.
    Fam. 25. Cynipseæ.

II. Imago with sessile and depressed abdomen; oviduct spiral. Larvæ gallivorous?.
  Fam. 26. Oryssini.

III. Imago with sessile and depressed abdomen. Larvæ eruciform, pedate, plantivorous.
  Fam. 27. Siricides [Uroceridæ], 28. Tenthredinides.

With the exception of the different location and juxtaposition of these primary groups the arrangement here given is not materially unlike that of Latreille. The section B appears to be a most artificial assemblage, sufficient to prove, in connection with the admission of Dahlbom (that certain parasitic species occur in the raptatorial, mellivorous, and gallivorous groups, which nevertheless agree completely in general habits, as, for instance, Psithyrus amongst the bees, &c.) that a distribution of the Hymenoptera, based upon natural habits

alone, is as completely artificial as any arrangement resting upon any other single character. Thus the Eumenides and Mutillariæ amongst the Parasitica are strictly raptatorial; and, if the parasitic Psithyrus, &c., be admitted into the Ædificatoria, there is no ground for excluding the Nomadini. In this respect the views of Dahlbom are not so precise as those of Saint Fargeau, which are based, not only upon the natural habits but also upon the precise structure of those individual organs which are employed in performing such habits.

Dr. Theodore Hartig, in a memoir published in *Wiegmann's Archiv.* 1837, No. 2., and in his *Die Aderflugler Deutchslands*, has proposed an arrangement founded upon the external characters of the imago, and originating in a dichotomy, nearly agreeing with that of Latreille, well characterised by the structure of the trochanters, a peculiarity not previously adopted for this purpose.

Hymenoptera Ditrocha (Trochanteribus biarticulatis)	abdomine connato	tibiis anticis spinis apicalibus duabus - -	H. Phyllophaga.
		tibiis anticis spina apicali unica - -	H. Xylophaga.
	abdomine vel sessili vel petiolato - -		H. Parasitica.
Hymenoptera Monotrocha (Trochanteribus inarticulatis)	Tarsorum postic. articul. 1 mus. simplex		H. Rapientia.
	Tars. post. articul. 1 mus. plerumque dilatatus - - - -		H. Anthophila.

The Phyllophaga comprises the family of the saw-flies; the Xylophaga that of the Uroceridæ; the Parasitica, those of the Evaniidæ, Ichneumonidæ, Chalcididæ, Proctotrupidæ and Cynipidæ?; the Rapientia consists of the Sand-wasps, Wasps, Ants, and Chrysididæ; and he Anthophila, the solitary, social, and parasite Bees.

The TEREBRANTIA, or first general and aberrant section of the Hymenoptera, is distinguished by having the posterior trochanters 2-jointed, and the abdomen in the females furnished with a lamellate or filiform, auger-like, and generally more or less exserted instrument, employed for the purpose of depositing the eggs in the various bodies destined for their reception. This instrument is connected with glands which do not secrete a highly concentrated poison, although it is evident that, in some species (as the Gall-flies, and some Tenthredinidæ), the act of oviposition is accompanied by the emission of an irritating and analogous fluid.* The antennæ are very variable in the

* The Ichneumonidæ, when alarmed, endeavour to use the ovipositor as an organ of defence, and certainly emit a fluid. (See E. W. Lewis, on Pimpla stercorator; and my additional observations, *Mag. Nat. Hist.* vol. vi. p. 414.)

number and form of their joints, both in the various species, and in the sexes of the same species. The females do not lay up a store of food, either of pollen paste, or other insects, for the supply of their progeny.

The section Terebrantia comprises the two subsections,

A. *PHYTIPHAGA.* Abdomen sessile. Divisible into
   a. *Serrifera.* ♀ armed with saws.
   b. *Terebellifera.* ♀ armed with a borer.
B. *ENTOMOPHAGA.* Abdomen pedunculated. Divisible into
   a. *Spiculifera.* Abdomen not tubular at the extremity; ovipositor spiculiform.
   b. *Tubulifera.* Abdomen tubular at the extremity; ovipositor sting-like.

Messrs. Saint Fargeau and Serville have proposed another mode of distribution of the Terebrantia, founded upon variations in the form of the ovipositor, proposing five families; namely, 1. Serrifera (Tenthredo), 2. Spirifera (Cynips and Oryssus), 3. Terebellifera (Chalcis, Ichneumon, Evania, and Sirex), 4. Canalifera (Proctotrupes), and 5. Tubulifera (Chrysis). I have not adopted this arrangement for the reasons subsequently detailed.

The first sub-section, Phytiphaga, Securifera, Sessiliventres, or Serrifera, as it has been variously named by Latreille and Saint Fargeau, is distinguished by having the abdomen sessile, hiding the base of the posterior legs. The ovipositor in the majority consists of two saws, which are alternately protruded and employed in preparing a place for the reception of the eggs, as well as in conducting them to their destination. In a few species (Terebellifera), the ovipositor is similar in its construction to the ovipositor of the Ichneumonidæ, &c., whilst in one genus (Oryssus), it is spiral. The larvæ feed entirely upon vegetable matters, for the most part upon leaves; a few, however, are internal feeders, and others reside in galls, in the manner of the Cynipidæ. The larvæ are furnished with completely developed organs of manducation; they also for the most part possess six short articulated legs, and a greater or less number of anal prolegs or other appendages.

The Phytiphagous subsection consists of two tribes, each composed of a single family, namely,

a. Serrifera, TENTHREDINIDÆ. Abdomen of the female furnished with a pair of saws.
b. Terebellifera, UROCERIDÆ. Abdomen of the female furnished with a borer.

The family TENTHREDINIDÆ*, *Leach*, corresponding with the Linnæan genus Tenthredo, comprises the insects ordinarily termed

Fig. 69.

Saw-flies (*fig.* 69. 1. Cimbex femorata ♂). The antennæ are variable in form, and in the number of their joints, from 3 to 30 (*fig.* 71. 2.

* BIBLIOGR. REFER. TO THE TENTHREDINIDÆ.

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Westwood, in Griff. An. K. Pl. (Perga scutellata). — Ditto, in Trans. Ent. Soc. vol. i. p. 234. (P. Lewisii). — Ditto, in Proceedings, Zool. Soc. April, 1835.

Newman, in Ent. Mag. Nos. 18. and 25.

antenna Hytoloma ♂, 71. 6. ant. of Crœsus Septentrionalis, 71. 25. ant. Cephus), but generally short, the basal joint not greatly elongated. Those of the males are in some species pectinated, furcate, or flabellate (*fig.* 71. 3. antenna Schyzocerus, ♂, 71. 4. ant. Lophyrus, ♂, 71. 5. Lophyrus ♀). The labrum is mostly transverse or quadrate, with the anterior angles rounded and pilose (*fig.* 69. 7.); the mandibles, which are larger in the males than in the females, are elongated, horny, narrow, compressed, and dentated (*fig.* 69. 3, 4, 5.); the maxillæ are elongated, membranous, and bilobed, with the maxillary palpi moderately long and 6-jointed (*fig.* 69. 5. 8.); the labium is small, arising from the membranous connection at the base of the maxillæ, and is trifid at its extremity, and the labial palpi 4-jointed (*fig.* 69. 4, 5. 9.). My *figs.* 69. 2—13. represent various details of Trichiosoma Lucorum, *figs.* 2—9. exhibiting parts of the mouth; *fig.* 69. 2. shows the front of the head, with the jaws closed, and the labrum folded over them; *fig.* 3. shows the jaws partially opened, and the labrum shut close down upon the maxillæ and labium, which are folded up and at rest in the oral cavity, as represented in *fig.* 4., in which the labrum is lifted up over the mandibles; *fig.* 6. shows the mode in which the maxillæ and labium fold up; in *fig.* 5. these parts are stretched out to their full extent, showing the basal parts or stipes of the maxillæ to be as long as the terminal parts; *fig.* 7. exhibits the labrum; *fig.* 8. the maxilla; and *fig.* 9. the labium separately.

The thorax forms a large solid mass, generally broader than the head, (*fig.* 72. 1. pro- and meso-thorax of a Cimbex, the prothorax dotted). The meta-thorax often exhibits two minute white spots (Cenchri, *fig.* 72. 2. and 3. × and *fig.* 73. 6. and 7. ×) at the sides of the part ordinarily termed the postscutellum. The hinder portion of the

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Bosc. Sur une Nouv. Esp. Tenthredo (T. Boleti), Nouv. Bul. Soc. Phil. 1818, and in Journal de Physique, Nos. 86 and 87. — Ditto, on Cephus pygmæus, in Bull. Soc. Nat. 1823.

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Brullé. Metamorph. Cladius difformis, Ann. Soc. Ent. France, vol. i.

Peck. Natural History of the Slug Worm, in the Collection of the Massach. Hist. Soc. vol. v. Boston, 1799. — (Ditto, published separately by Young and Minns).

Linnæus, Fabricius, Rossi, Panzer, Stephens, &c.

metathorax or metascutellum (*fig.* 72. 2. and 3. s.), is divided from its anterior part or metapræscutum (*ibid.* z.), by a deep impression, extending down the sides (incorrectly figured by Burmeister, *Manual*, pl. 12. No. 1. f. 2.), so that it appears to be a distinct segment (and consequently portion of the abdomen), it is also furnished on each side with a spiracle (*fig.* 72. 3. o.).*

* That this hinder division (s.) is really a portion of the mesothorax may at once be seen by carefully comparing figures 72. 1, 2, 3. with the thorax of Cephus, Urocerus, or especially Oryssus (*fig.* 73. 6, 7.); in all which, as indeed in other shorter-bodied species, the dorsal and ventral arcs of the real abdominal segments will be found to correspond together. In Cimbex (*fig.* 72. 2, 3.), the episternum (*ibid.* v.), and epimeron (*ibid.* y.) of the metathorax, are well defined, the latter giving support to the base of the posterior coxæ (*ibid.* t.), whilst the metascutellum is large, with the edges acute, and the sides deflexed (*ibid.* s s.), and extending to the base of the posterior coxæ, having the metathoracic spiracle (o.) on its deflexed sides. The analogy of these pieces with those of Vespa, figured by MacLeay (*Zool. Journ.* vol. v. pl. 5. *fig.* 1.) is unquestionable. In Oryssus, the metathoracic epimeron and episternum are confluent (in the piece marked y. in *fig.* 73. 7.), and the metascutellum (*ibid.* s.) has no acutely deflexed side, having a longitudinal direction. It might, perhaps, be at first supposed that the two arcs r. in this figure represented s s. in *fig.* 72. 3.; but the position of the Cenchri (×) in the piece marked z. in *fig.* 73. 7.; and the circumstance that these two arcs have a distinct motion like the other abdominal segments, clearly proves that s. is metathoracic and r. abdominal. In some species (Cimbex, *fig.* 72. 1, 2, 3.), the posterior margin of the metathorax is deeply emarginate, so that it is connected with the first abdominal dorsal arc by a slender white membrane (*fig.* 72. 2, 3.†), which I regard as analogous to the funiculus *K.* of the petiolated species. In many other species, as in Allantus, Tenthredo (and also in Urocerus), this hinder part of the metathorax is slit down the centre, whilst in Cephus, &c., the slit is dilated into a triangular excision, covered with yellow membrane. Great confusion and consequent inaccuracy in the description of the colouring of the respective abdominal segments has originated in the want of a careful discrimination of the structure of this piece; for instance, in Allantus lividus the basal segment of the abdomen is said to have a white spot on each side (*Steph. Ill. Mand.* vii. p. 66.), whereas it is the posterior portion of the metathorax which is thus marked. In Zaræa fasciata, ♀, the colours are still more strongly marked. By all authors the abdomen is described as black, with the basal segment white, whereas the white segment is part of the metathorax. In Oryssus coronatus the abdomen is said by all authors to be rufous, except the two black basal joints; whereas it is the hinder portion of the metathorax (which is not slit, *fig.* 73. 6. s.) and the basal segment of the abdomen alone (r.) which are coloured black. In Urocerus, likewise, the abdomen is described as 9-jointed, whereas it has but eight segments; the hinder part of the metathorax having been regarded as the basal segment of the abdomen. The notes of Latreille upon this subject are completely at variance, supporting two distinct theories. He distinctly states (*Règne An.* tom. v. p. 268.), that the segment which bears the inferior wings is separated from the following, "ou du premier de l'abdomen, par une incision ou articulation transverse." Now the part which pre-

The wings are of ample size, with numerous complete cells *, and a large stigma; the legs are of moderate length; the posterior tibiæ † are spurred in the middle in some genera; the calcaria are of various shapes; and the four basal joints of the 5-jointed tarsi (*fig.* 69. 10.) generally furnished beneath with small membranous appendages, which in some species resemble minute cups (*fig.* 69. 11.). In the male Cimbices, the basal-joint of the four posterior tarsi is produced into a spine beneath, and clothed with wool (*fig.* 71. 1., hind leg, Cimbex, ♂, showing the 2-jointed trochanter). The abdomen is sessile, subcylindric, and terminated in the females on the underside in a pair of compressed sawlike plates, applied against each other. These organs are curved upwards, and each is formed of two distinct portions, namely, the saw itself and the back support; the lower edge of the saw is finely denticulated and its upper edge is received in a groove on the under and thickened edge of the support, which is a flattened piece, also serrated on the upper edge, and which acts not unlike the back of a common saw. These organs are also obliquely ribbed, so that they present a very elegant appearance. When at rest these organs are received between another pair of larger and flattened plates or valves, articulated in the centre; a pair of minute pilose styles is also attached to the extremity of the last abdominal segment on each side, which has been overlooked by Entomotomists ‡, but which

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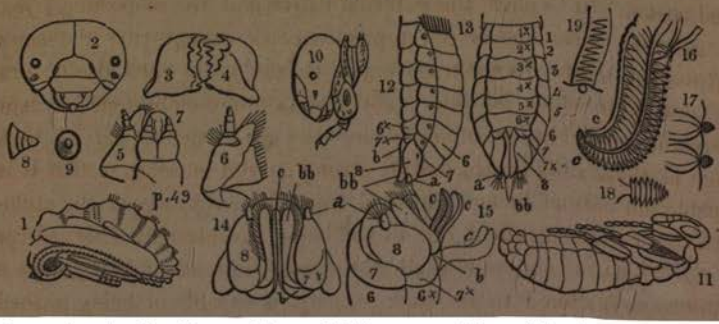
cedes this "incision" bears a pair of spiracles (*Burmeister Manual*, pl. 12. No. 1. 1 *β*.) In p. 264., of the same work he had however as expressly said that the metathorax "est très court, ne forme qu' un arceau supérieur, et il est ordinairement intimement uni avec le premier segment de l'abdomen," which last presents two spiracles; and consequently, that the peduncle in those species in which the abdomen is pedunculated, is the second abdominal segment; the latter theory being adopted from the views of M. Audouin, as above noticed, in the general observations upon the order. It is true, that in many Saw-flies the hinder portion of the metathorax, notwithstanding its peculiar character (slit or excised), has so much the appearance of a segment of the abdomen, that the correctness of the above observations will be called in question. If denied, however, we shall be compelled to adopt the still less tenable theory of Audouin and Latreille. Saint Fargeau has indeed ventured to overcome the difficulty by rejecting both theories, considering (*Hist. Nat. Hym.* p. 4.) this hinder part of the metathorax as abdominal in the Sessiliventres, and (*Ibid.* p. 78.) as thoracic in the Pedunculiventres.

* Jurine asserts that the number of cells in the wing of the imago is regulated by the number of prolegs in the larva.

† I possess an anomalous undescribed genus of this family from Africa, entirely destitute of calcaria.

‡ Except by Mr. Newman, who, apparently unaware of their general existence, has named a genus in which they are prominent Euura.

Fig. 70.



also exists in the Uroceridæ and Ichneumonidæ. My *figs.* 70. 12—19. illustrate the structure of the saws of these insects, as exhibited in Trichiosoma Lucorum. *Fig.* 12. represents the abdomen of the female of this insect seen laterally, and 13. the same seen ventrally; *fig.* 14. shows the extremity of the abdomen beneath, with the terminal segments partially opened, whilst *fig.* 15. exhibits the same parts seen laterally, with the saws themselves partly exposed. In these figures the segments are severally numbered, the ventral arcs being distinguished by the addition of x, as 7 x; a indicates the minute exarticulate style above mentioned; b represents the basal, and b b the apical part of the outer sheaths of the saws; *fig.* c represents the saws themselves, c showing the back piece or support, and *c* the saw piece (as in *fig.* 16.); in *fig.* 15. the position of the saws in action is represented by the dotted part of the figure; *fig.* 16. represents one of the saws of Trichiosoma separately, and much more highly magnified; *fig.* 17. exhibits still more highly magnified part of the edge of the sawing part, *fig.* 18. being one of the minute transversely striated teeth of the saw, whilst *fig.* 19. shows part of the inner surface of one of the saws of Cimbex, to represent the zig-zag grooves on its surface.

The form of the saws varies considerably in its minute details in different species, and from its admirable construction it cannot be doubted that a careful examination of its various modifications might furnish ideas for improved mechanical instruments. In some species the edge of the saw is very obtusely serrated, but the longer portion of each serration is very finely denticulated. In others the serrations are much more acute, and the denticulations on one side of each of considerable length, in others the edge of the saw is furnished with minute rounded lobes, whilst in others these marginal lobes some-

what resemble leaves separated by a smaller rounded lobe with radiated costæ. In Cephus, the external valves and the ovipositor (*fig.* 71. 24.) are formed as in the typical species, except that the saws and their supports are not transversely striated: the same also occurs in Xyela *, in which the saws and supports are membranous, except down the central line of union, where they are corneous (*fig.* 71. 14.). Each of these saws is attached by strong curved muscles, so that it is capable not only of being protruded from the extremity of the abdomen to a certain distance, but also of being considerably deflexed (as in *fig.* 70. 15.): moreover, each of the saws, instead of being, like a common saw, affixed to its back support, is capable of being pushed forwards and backwards, whilst the support remains fixed. In some genera, Lyda, &c. (*fig.* 71. 10.), the base of the saws is greatly dilated and elbowed. With this admirably contrived pair of instruments the female Saw-fly forms a slit in the stems or leaves of plants, the two saws acting upon the same spot with an alternate movement, one being protruded, whilst the other is drawn backwards, and *vice versâ*.

The action of these instruments, and their structure, has been minutely described by Reaumur (*Mémoires*, vol. v.; and by Blot, in the *Mem. Soc. Linn. du Calvados*, vol. i.). There is considerable difference in the mode in which these incisions are made: thus Hylotoma Rosæ makes a simple series of slits, whilst H. Pagana makes two series close together. Each series consisting of numerous slits, but each slit contains only one egg. Some species, on the other hand, introduce their eggs by means of their saws into the edges of leaves (Nematus conjugatus, *Dahlb.*), and others beneath the longitudinal ribs of the leaves. A few, indeed, merely fasten their eggs upon the outer surface of the leaves (Nematus Grossulariæ, &c.) attaching them together like a string of beads (*Reaumur*, vol. v. pl. 10. f. 8.), whilst a few place them in a mass on the surface of the leaf (*ibid.* pl. 11. f. 8, 9.). When the wounds thus formed are completed, an egg is deposited in each, passing down the channel or cavity formed by the internal union of the saws and their supports, by which it is conducted to its proper destination: the deposition of each egg is accompanied by a drop of frothy matter, which is supposed to prevent the closing of the wound. Moreover, the sides of the saws are

* By Dalman and Curtis the ovipositor of this genus is represented as single. I have however ascertained, by dissection, that it consists of two plates inclosed between the two ordinary valves.

provided with a vast number of very minute points, which serve to irritate the wound, and to cause an overflowing of the sap; the wounds further increase in size, according to the growth of the egg, the latter curious circumstance having been discovered by Vallisnieri, and also recorded by Reaumur (vol. iii. p. 579., and v. p. 121.); the eggs imbibing nutriment in some unknown manner, through their membranous skins, from the vegetable juices which surround them, and attaining twice their previous size. Sometimes also these attacks are succeeded by the production of galls of various kinds, which serve for the residence and support of the young larvæ. In general, however, the larvæ are external feeders; occasionally, as in the species which feed upon the leaves of the turnip and gooseberry, occurring to so great an extent, that they are the cause of real injury to the farmer and horticulturist. These larvæ, in their form and colours, as well as in the number of prolegs with which they are provided, have a very considerable resemblance to those of the Lepidoptera; in the true caterpillars, however, the legs and prolegs do not exceed 16 in number, whereas the false caterpillars of the Tenthredinidæ, (with a very few exceptions), have from 18 to 22. The prolegs differ from those of the Lepidopterous larvæ, in being simply membranous, and destitute of the coronet of curved spines which exist in the latter. The body is divided into twelve cylindrical segments, exclusive of the head (*fig.* 70. 2—9. head and details of Trichiosoma larva) having nine pairs of spiracles (*fig.* 70. 10., head and prothorax of larva of Cimbex, to show the prothoracic spiracle). They have only two simple eyes (*fig.* 70. 9.) placed at the sides of the head; the antennæ are very short and conical (*fig.* 70. 8.); the upper lip is generally emarginate in the middle. The mandibles are powerful, horny, and more or less toothed (*fig.* 70. 3, 4.); the maxillæ are membranous and bilobed, with short, 4-jointed palpi (*fig.* 70. 5. maxilla in situ, 70. 6. ditto, separated), and the labium is small and fleshy, with very short conical, 3-jointed labial, palpi (*fig.* 70. 7.), and provided with a spinnaret and silk secretor, but they produce silk in a very small quantity. They almost exclusively feed upon the leaves of various trees and plants. They have also the habit, especially when alarmed, of rolling themselves up in a spiral manner, so that in this position they bear a very considerable analogy to the Iulidæ. Their colours are generally green, of various shades, with lines and spots of various colours. They shed their skins several (ordinarily four) times, materially

changing in appearance after the last moulting. The larvæ of the different genera vary in the number of the legs. Those which have been observed with sufficient accuracy may be thus arranged.

Larvæ with the extremity of the body not armed with a spine: —

A. Larvæ with 22 legs (6 pectoral, 14 abdominal, and 2 caudal).
   a. Feeding upon the leaves of plants.
      Solitary, resting in a spiral manner, ejecting a fluid from the pores of the body; forming a cocoon. (*Cimbex, Trichiosoma, Clavellaria.*)
      Solitary or social, not ejecting a fluid from the sides of the body; forming, or not forming, a cocoon. (*Tenthredo, Athalia,* and certain *Allanti,* and *Dolerus.*)
   b. Feeding upon the leaflets of the pine, social, not ejecting a fluid from the sides of the body; quiescent, attached by the legs to the edges of the leaflets; forming a cocoon. (*Lophyrus.*)

B. Larvæ with 20 legs (6 pectoral, 12 abdominal, and 2 caudal).
   a. Feeding upon the leaves of plants; resting at the edges, or upon the surface of leaves. (Hylotoma atrata, &c., *Cladius, Pristiphora, Nematus, Cræsus,* and certain *Tenthredines* [likewise *Zaræa* and *Abia,* according to St. Fargeau].)
   b. Feeding upon the leaflets of the pine, social; resting at the edge of the leaflet; forming a simple cocoon. (*Nematus abietinus* and *Leachii.*)
   c. Living in the galls of plants. (*Nematus intercus,* &c.)

C. Larvæ with 18 legs (6 pectoral, 10 abdominal, and 2 caudal). *Hylotoma enodis.*

D. Larvæ with only 6 pectoral legs. (*Lyda* [and *Xiphydria,* according to Dahlbom, but see *infrà*] *Cephus.*)

This table is abstracted (with additions), from Dahlbom's *Synopsis Larvarum Scandinavicarum eruciformium ex ordine Hymenopterum,* contained in the work above noticed; in which Dr. Dahlbom has given careful descriptions of 63 species of larvæ belonging to this family. Dr. Hartig has also entered into considerable details relative to the transformations of the different genera, in his *Die Blattwespen, &c.,* a work which, for minute and careful investigation into the structure and habits of these species, in all their states, may be considered as one of the most excellent entomological works hitherto published. Gœdart, Réaumur, and De Geer, published figures of many species in their different states, but those of the two former authors are often too rude to be determined. (See also Bergman, in the *Stockholm Transactions* for 1763, and in those of the *Acad. of Upsal* for 1767; likewise Disderi, in *Transactions Turin Acad.* vol. ii., on the larvæ of this family.)

The larvæ of the larger species (Cimbex, &c.) have twenty-two feet, the body being covered with minute granular setigerous tubercles, like those of some of the Smerinthi, and, when alarmed, they dis-

charge a clear greenish watery fluid, from lateral pores placed above the spiracles, to a considerable distance. This, however, only takes place when the insects are in a state of nature, and is exhausted after seven or eight discharges. (Fennell, in *Mag. Nat. Hist.* No. 32.) These larvæ always rest on the upper surface of the leaf, rolled up in a spiral direction, the tail occupying the centre. They attain a considerable size; and, when full grown, they construct a strong parchment-like cocoon of a brown colour, which they attach to the branches of the trees upon which they have been feeding, or beneath fallen leaves on the surface of the earth, and in which after remaining a considerable period in the larva state, they are changed to inactive incomplete pupæ, which state lasts but a short time. De Geer (*Mémoires*, tom. ii. tab. 33. f. 1—16.) and Lyonnet (*Posth. Mém.* pl. 15. f. 20—29.) have published complete details of the transformations of Cimbex lutea; and in De Geer's figs. 17—24. are given those of Clavellaria amerinæ. His tab. 34. f. 1—8., and Hartig (pl. 1. f. 1—23.) represent Cimbex femorata (variabilis) in its different states, with elaborate details. It is in the months of August and September that the larva of this insect is to be found on the alder, birch, and beech. From the diversity of its food, Dahlbom states that varieties in the imago, which have been regarded by Leach and others as distinct species, have been produced. Drewsen (in *Ann. Soc. Ent. de France*, 1835, p. 169.) has communicated some observations proving that this insect ordinarily remains two years in its cocoon. Frisch (*Beschr. Ins. Deutchsl.* vol. iii. p. 25.), Albin (*Nat. Hist. Engl. Ins.* pl. 59.), Dahlbom in *Wetensk. Acad. Handl.* 1834, and Roesel (*Ins. Belust.* vol. ii., Bomb. and Vesp., tab. 13.) have represented the transformations of this species, whilst those of Clavellaria amerinæ have been also described by the last author (*Op. cit.* tab. 1. f. 1—4., and tab. 2.; and by Gœdart, *Ins.* tom. i. pl. 64.). In its earlier stages its larvæ are gregarious, but by degrees they become more and more solitary. Its cocoon is not so strongly formed as that of Cimbex femorata, and is reticulated. Lyonnet (*Posth. Mém.* pl. 16.) has given complete details of another large species of Cimbex, which De Haan gives as C. sylvarum; but, both in his pl. 15. f. 20. and pl. 16. f. 1., the larvæ are represented incorrectly, the apodal segment succeeding the metathoracic segment being omitted.

The larvæ of Trichiosoma lucorum (*fig.* 69. 12.) are not of uncommon occurrence on the white thorn at the beginning of August. From

the large size and attractive appearance of these larvæ, they are occasionally attacked by ichneumous parasites. I have obtained two distinct species of Ichneumonidæ from one cocoon belonging to an individual of Trichiosoma lucorum. I have likewise obtained specimens of a species of Ichneumon, and others of one of the Pteromalidæ, from one cocoon.* Mr. Woodward also noticed the occurrence of parasites in the cocoons of this insect, in the *Mag. Nat. Hist.* No. 23. The cocoon (*fig.* 69. 13., cut open to show the enclosed pupa) of this insect is as large as a small bird's egg, and is attached to the branches of the white thorn, upon which it may be easily perceived in the winter, when the trees are destitute of leaves. In one which I observed the larva remained in that state through the winter, not assuming the pupa state till the end of April, and the insect appeared in the perfect state in about a fortnight.

The larvæ of the genus Hylotoma are distinguished by having the sides of the abdominal segments produced over the legs, and the base of the claws of the thoracic feet is furnished with a large fleshy tubercle. (Hartig, pl. 2. f. 12.) The larvæ of H. Rosæ are ordinarily observed on the leaves of the rose, resting with the extremity of the body elevated, and often curved into the form of S.

Some larvæ belonging to this genus have twenty feet, namely, six thoracic and fourteen abdominal. Here belongs the insect which feeds upon the birch, figured in its different states by De Geer (*Mém.* t. ii. p. 38. f. 32—35.), which has been given as Abia nitens, but which Hartig and Dahlbom properly regard as *Hylotoma ustulata*; as well as a species which feeds on the rose, which Dahlbom gives as *H. atrata* Klug, but which St. Fargeau gives as H. ustulata; also figured by De Geer (tab. 39. f. 14—20.).

The other larvæ in this genus have only eighteen legs; or, rather, the pair on the seventh abdominal segment are so small as to appear nearly obsolete. (Hartig, p. 76.) Of these species Rösel (*Ins. Belust.* vol. ii. Bomb Vesp. tab. 2.) and De Geer have figured H. Rosarum *Klug*, *Hartig* (Rosæ *St. Farg.*), *Dahlbom*, *Bouché* (*Naturgesch.* p. 135., in his plate 39. f. 21—29.), which feeds on different species of roses; and H. enodis *Linn.*, *Dahlbom*, and *Hartig* (H. atro-cærulea *St. Fargeau*), which feeds upon the sallow, is figured by De Geer (pl. 40. f. 1—6.). Réaumur has figured the history of two species of Rose Hylotomæ in his *Mémoires* (tom. v. pl. 14 and 15.).

* The details of these observations will form the subject of a separate memoir.

The cocoon in this genus is double; the outer being reticulated, and the inner compact and close, but paler coloured.

Amongst the smaller species, with 22-footed larvæ, which do not emit a fluid from the pores of the body, those of Allantus tricinctus *Fab.*, *Hart.*, *Dahlb.*, which feeds upon Lonicera caprifolia (Tenth. vespiformis *St. Farg.*, T. rustica *Fourc.*), have been observed by De Geer (*Mém.* tom. ii. tab. 34. f. 9—19.), and Hartig (tab. 5. f. 39.); likewise those of Allantus pulveratus *Retz.* (leucozonius *Hartig*, *Ibid.* tab. 34. f. 20—25.).

The 22-footed larva of Allantus scrophulariæ *Linn.* is described by Bouché (*Naturg. Ins.* p. 138.), and figured, with the details of the transformations of this species, by Réaumur (*Mém.* tom. v. pl. 13. f. 12—23.). The insect does not form a regular cocoon, but merely constructs an earthen cell at the foot of the Scrophularia. It is also figured in the *Entomol. Mag.* (vol. i. pl. 1. f. 2, 3.), varying in colour very considerably after the penultimate moulting of the skin of the larva. An allied species, A. flavicornis *Kl.*, luteicornis *Fab.*, has been figured, in its different states, by Lyonnet (*Mém. Posth.* pl. 15. f. 13—18.). The larvæ of Emphytus cinctus and rufo-cinctus *Klug* (T. pavida *St. Farg.*) are found upon the rose in the autumn. The latter species is figured, in its different states, by De Geer (pl. 35. f. 14—18.). The former, when full grown, quits the leaves, and burrows into the pith of the stem to the depth of several inches, closing the aperture with its excrement, and thus forming a safe retreat for itself. (Réaumur, tom. v. p. 163. pl. 10. f. 1, 2, 3.; Bouché, *Naturg. Ins.* vol. i. p. 139., by whom the transformations of Emphytus perla are also described, *Ibid.* p. 140.)

The preceding species have smooth-bodied larvæ. Those of Selandria ovata *Linn.*, forming (with some other species) the section named Eriocampa by Hartig (p. 279.), are 22-footed; but have the segments of the body clothed with small patches of white woolly matter, giving them still more the appearance of certain caterpillars. (De Geer, *Mém.* tom. ii. pl. 35. f. 1—13.) This matter is easily rubbed off, and is not found after the final moulting of the caterpillar, which is found upon the alder. The cocoon is double.

The larvæ of Selandria bipunctata are 22-footed; but they are distinguished by having each segment of the body armed with strong spines, forked at the tip, but which do not exist after the penultimate moult of the larva. De Geer has represented one of these

larvæ (*Mém.* tom. ii. pl. 35. f. 19, 20., adding figures of simple, bifurcate and 4-furcate spines); he was, however, unable to rear it. Hartig has figured another similar larva, found on the oak (tab. 5. f. 27—30.), and which he gives as that of Tenthredo bipunctata (p. 262—277.), forming it (with some others) into the subgenus Hoplocampa, from the spines with which the larvæ are armed. Réaumur (*Mém.* tom. v. pl. 12.) has figured two species of these armed larvæ, found upon the oak and Prunus domestica; Lyonnet has also described one of these species of spined larvæ, found upon the oak (*Mém. Posth.* pl. 15. f. 1—12.), which he succeeded in rearing to the perfect state, and which De Haan doubtingly gives as the Dolerus hæmatodes of Klug.

De Geer (tom. ii. pl. 38. f. 11—13.), Réaumur (tom. v. pl. 12. f. 17, 18.), and Dahlbom, have figured a very curious 20-footed larva, found upon the alder, having the body flattened, and greatly resembling the larvæ of the butterfly genus Thecla, or the flattened Aselli. Neither of them were able to rear it, nor has Hartig been able to point out the group to which it belongs; he, however, introduces it into his great genus Tenthredo, copying De Geer's figure (pl. 5. f. 41.).

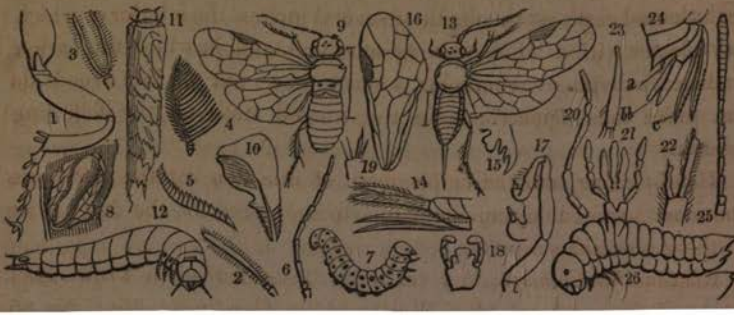
Lyonnet (*Posth. Mém.*, pl. 14.) has given complete details of the various states and structure of an undetermined species of Dolerus? * of which the larva is 22-footed.

The 20-footed larvæ of Selandria cerasi *Linn.* (Æthiops *Fab.*), which feed upon the leaves of plum and other fruit trees, are remarkable for the entire covering of greenish black viscid matter with which they are clothed, and which exudes from the sides of the body. By day they remain quiet upon the surface of the leaves, with the head withdrawn into the prothoracic segment, and the latter distended; the legs are also concealed, so that the insect has not the least appearance of animation, and looks more like a small portion of slime (*fig.* 71. 8.). (De Geer, tom. ii. tab. 38. f. 16—24.; Réaumur, tom. v. plate 12. f. 1—4.; Bouché, *Naturgesch. Ins.* p. 137.; Westwood, in *Gardener's Mag.* No. 92. November, 1837.) This, together with some allied species, has thence been formed by Hartig into the subgenus Blennocampa. (See his pl. 5. fig. 31.)

To this subgenus also belongs the "slug worm" of North America, which occasionally commits so much injury on the cherry, pear, plum,

* The antennæ are described as only 7-jointed, but are represented as 8-jointed; but evidently incorrectly, as no species of the family has yet been described with eight joints.

Fig. 71.



and quince, in the United States. Its history has been completely detailed by Professor Peck, in the memoir above noticed, and who reared one of the Encyrti (?) from it.

The 22-footed larva of Athalia spinarum, according to Dahlbom and Drewsen (*Clav. Nov. Hym. Syst.* p. 16.), is gregarious, and feeds upon various species of Brassica, which it completely strips of its leaves, leaving only the stronger nerves. There are two generations in the course of the summer; and the larva does not form any cocoon, but merely encloses itself in an oval cell in the earth, of which it plasters the sides with a glutinous secretion, mixed with the earth.

The 22-footed larva of Athalia centifoliæ has periodically, in this country, proved to be one of the most obnoxious of our insect enemies. It is of a greenish black colour, whence it has obtained the name of the nigger, or black caterpillar, of the turnip, to which plant it is chiefly detrimental, by devouring the leaves, and thus totally destroying the crop in an incredibly short space of time. Albin, in his *Nat. Hist. of English Insects*, 1720, pl. 62., first figured this insect in its different states, observing that whole fields were occasionally destroyed by it; and an instance is recorded in the *Philos. Transact.* for 1783 (vol. lxxiii. p. 317.), by Mr. Marshall, in which their destruction was so great that many thousand acres were obliged to be ploughed up. In 1835, 1836, and 1837, it was exceedingly abundant and injurious. The appearance of the blacks is preceded by that of the imago, a pretty yellow and black species, which first appears about the middle of May or beginning of June, depositing its eggs within the parenchymatous tissue of the leaf, introducing her saw between the edges of the cuticle; and from which, in five or six days, the larvæ are hatched.

These are very voracious, and shed their skins several times. When full grown, they descend into the ground, forming an oval cocoon of agglutinated earth, at the depth of several inches, the interior of which they plaster with a white shining secretion, and in which the earlier produced individuals remain but a short time; but the late broods do not make their appearance in the winged state till the following season.

Hand-picking, and the employment of ducks to eat the grubs, are the most serviceable remedies hitherto suggested for the destruction of these obnoxious insects.

Rusticus, in *Entomol. Mag.* vol. iii. p. 339.; Yarrell, in *Trans. Zool. Soc.* vol. ii. p. 67. pl. 14.; Westwood, in *Gardener's Mag.* No. 86. May, 1837; W. C., in *Saturday Mag.* vol. vi. p. 181.; Curtis (*Brit. Ent.*, October, 1836); W. W. Saunders, in *Trans. Ent. Soc.* vol. i. p. 76. App.; and especially Mr. Newport, in his admirably elaborate prize essay (1838), have given ample details of the history, &c., of this species.

M. Brullé has published an account of the transformations of Cladius difformis *Klug* (*Annal. Soc. Ent. de Fr.* 1832, pl. 11. f. 11, 12.), the larva of which is found upon the leaves of Rosa centifolia and Bengalensis. Curtis also reared this species from larvæ found on the under side of the leaves of the China rose, eating small holes through them. Dahlbom once observed it upon Salix viminalis: it is slender, subcylindrical, clothed with slender upright hairs, and 20-footed. Curtis says that the anal feet do not assist them in walking. They are full-fed on the 28th of July, and the imago appears on the 11th or 12th of August, and they form a double cocoon of a very irregular shape amongst the leaves. Hartig has figured the larva and imago of Nematus (Pristiphorus) albipes, with numerous details (pl. 2. f. 16—26.). The larva is 20-footed, and closely resembles that of Cl. difformis; it feeds upon the under side of the leaves of the cherry. The larva of Nematus (Pristiphorus) Brullei *Dahlb.* (Priophorus *B.*) is very similar to the preceding, and inhabits the Rumex and Rubus fruticosus; it is 20-footed, and forms a double cocoon, composed of a glutinous secretion, mixed with very fine silken threads.

One of the most destructive insects in the family inhabits the gooseberry, upon which the larvæ are found in society; from 50 to more than 1000 being sometimes observed upon a single tree, of which they devour all the leaves in the beginning of the summer, so that

the fruit cannot ripen. There are two generations in the course of a year. The larvæ are of a glaucous colour, with numerous transverse rows of black shining piliferous warts; they are furnished with 20 feet. The insects also undergo their transformations in society, one attaching the end of its cocoon to the end of the next. The species has been named Nematus grossulariæ by Dahlbom, who has given the history of the species in the *Vetenskaps. Acad. Handl.* for 1835, and who considers it as identical with the insect represented by Réaumur (tom. v. pl. 10. f. 4, 5.), which feeds upon the "groselier;" but that author states that his insect had 22 feet. Bouché (*Naturgesch.* p. 140.) describes the insect as the Tenthredo ventricosa *Klug* (Nematus v. *Hartig*, p. 196.). The Caledonian Horticult. Society has published a number of plans for the destruction of these caterpillars. (See also E. S. in *Mag. Nat. Hist.* No. 13.; vol. v. of the New Series of the *Manchester Memoirs; Hort. Mag.* 1831.) Stephens has described an allied species (Nematus Ribesii), the larva of which feeds upon the red currant.

At the end of June, 1838, I observed that nearly the whole crop of the young apples in the garden of my residence at Hammersmith had fallen to the ground, being then about the size of small walnuts; and, on opening some of them, I found the interior devoured by one or more larvæ of one of the Tenthredinidæ (probably a Nematus), having 6 thoracic, 12 abdominal, and 2 anal feet; the body not pilose, with thick lateral wrinkles. Its appearance in the perfect state will not take place until the next spring, when I hope to be able to add the name of this curious and destructive species. When alarmed, this larva emitted an odour like that of Cimex lectularius. The larva of Nematus dimidiatus feeds upon the poplar; it is yellow, with a black head, and large lateral black spots; it is figured in the *Entomol. Mag.* vol. i. pl. 1. f. 1., and is stated to have 14 abdominal legs.

The 20-footed larvæ of Nematus ochraceus *Hartig* (p. 218.), found upon the willow, in society, generally attach themselves to the edges of the leaves, the prolegs being placed on the opposite sides. Here they continue to feed incessantly, with the hind part of the body elevated in the air, and which, when disturbed, they throw about in various directions. De Geer has figured the history of this species (*Mém.* tom. ii. pl. 37. f. 1—11.). Réaumur also appears to have intended this, or a closely allied species, in his vol. v. tab. 11. f. 3—6. De Geer has also figured another very closely allied species, N. melanocephalus

Hartig (which St. Fargeau gives as the T. salicis *Linn.*), in the same plate (figs. 12—22.); and his fig. 23. is given by Hartig under the name of N. betulæ. The last-named author has also figured the larva and imago of another species (N. abietum), with details (pl. 4. f. 11—24.).

The 20-footed larva (*fig.* 71. 7.), of Crœsus septentrionalis, which lives in society upon the elm, protrudes a series of black fleshy tubercles between the abdominal legs when it is alarmed, but which are withdrawn into the body when the danger is passed. (De Geer, *Mém.* tom. ii. pl. 37. f. 24—28.) It is also figured in the *Entomol. Magazine*, vol. i. pl. 1. f. 5. The larva of another species of the same genus, of a fine green colour, with 9 rows of black dots, is found upon Salix viminalis. It is figured by Gœdart (t. 1. pl. 19.), Frisch (st. 6. t. 4. f. 1—7.), Réaumur (tom. i. pl. 1. f. 18.), and De Geer (tom. iii. pl. 38. f. 1.), and is supposed by Dahlbom to be the Nematus varus *Villaret* (*Ann. Soc. Ent. de France*, tom. i. pl. 11. f. 8.); T. salicis *Linn.*, *Réaum.*, tom. v. pl. 11. f. 10.

De Geer has also figured the larvæ of several species of Nematus, which are 20-footed, and are not gregarious in the larva state; namely N. caprææ (*Mém.* tom. ii. pl. 38. f. 1.;) N. nigratus *Hartig*, *Retz.* (*Ibid.* f. 2—4.), both on the willow; and N. interruptus *St. Farg.*, 249.; N. abietinus *Dahl.* (*Ibid.* 5—7.), on the fir; likewise the 20-footed larva of Dineura De Geerii *Hartig*, which St. Fargeau gives as Nematus varius. Frisch has figured the various states of Nematus salicis (*Beschr. &c.* vi. 4.); Dahlbom has also described the larvæ of many species of Nematus, which he divides into those which are gregarious, or solitary. A correspondent of the *Mag. Nat. Hist.* (vol. vii. p. 423.) has published an account of the devastation committed by Nematus caprææ to osiers, producing a loss of at least 200*l.*, by devouring the leaves annually, and thus destroying the young plants.

Several small species of Nematus deposit their eggs in the young shoots of the willow, causing the formation of woody galls upon the stem in which several larvæ reside in society, and undergo all their changes (N. medullarius *Hartig*, *De Geer*, tab. 39. f. 1—13.; N. pentandræ *Dahlb.*; T. salicis pentandræ *Vill.*), or of globose spongy pedunculated galls along the main rib of the leaf (*De Geer*, tab. 38. f. 26—31.; N. intercus *Panzer*, *Dahlbom*; N. gallarum *Hartig*, *De Geer*, tab. 38. f. 26—31.), in which a single inhabitant resides during the larva state. Another kind of gall is produced upon the leaves of various kinds of

* Mr. Paget (*Nat. Hist. Yarmouth*, App.) states that the larvæ of this species are very abundant on willows, entirely stripping many of these trees of their leaves.

willows by another species (Nematus gallicola *Westw.*, *Steph.*; N. saliceti *Fallen*, *Dahlb.*; Tenthredo Gallæ foliorum salicis *Linn.*, *Frisch*, *Ins. Germ.*, vol. iv. p. 22. tab. 4.; Réaumur, tom. iii. pl. 37. f. 1—5. 8.). These galls are irregular in shape, and often of a red colour. They extend on both sides of the leaf, and are of a spongy substance. They are at first solid, but by degrees a cavity is formed in the centre, by the feeding of the inclosed inhabitant; which, when full fed, quits the gall and descends to the earth.

I have traced the natural history of this third kind of gall-making Nematus *, and have ascertained that it is attacked by a beautiful species of Eulophus (E. Nemati *W.*), the female of which pierces the substance of the young gall. (See also Rösel, *Insect. Belust.* vol. ii. Bomb. et Vesp. tab. 10., wherein are figured these two leaf-gall-making species in their different states; and Swammerdam, *Book of Nature*, pl. 44., in which N. gallicola is represented in its different states.) Euura Cynips *Newman* (*Ent. Mag.* No. 18.), allied to N. gallicola, also resides in galls in the larva state.

The 22-footed larvæ of the genus Lophyrus are social (each family consisting of from 50 to 100 individuals), and devour the leaves of various species of firs; they also gnaw the young twigs, forming channels of some depth: they commonly repose along the leaves, having their heads inclined on one side. When touched they emit from the mouth a drop of clear fluid, of a resinous smell. The females are much larger than the males, and may be distinguished by this character in all their stages. De Geer (*Mém.* tom. ii. tab. 35. f. 24—27., and tab. 36. f. 1—30.) has represented the details of two species of this genus, L. rufus and L. Pini. The cocoon is simple, and never made in the earth; it is of very small size compared with that of the larva by which it is formed, and which is compelled to lie in a curved direction within. Curtis states that one of Dr. Leach's caterpillars of L. pallidus, remained in its cocoon unchanged for two years. Schæffer has given the history of one of the species of this genus under the name of Die Tannensagfliege (*Abhandl. von Ins.* vol. ii. tab. 8.), with figures. In the first vol. of the *Gardener's Mag.* (1826) is contained a notice of an 8vo vol. by D. E. Müller, on the ravages committed by the caterpillars of Tenth. Pini, Pinastri, Juniperi, and erythrocephela, by which several thousand acres of pines were entirely destroyed in Franconia. (*Ueber den Afterraupenfrass, &c.* Aschaffen-

* The details of these observations, with the history of its parasite, will form the subject of a separate memoir.

burg, 1821.) But the most complete account of the genus has been published by Hartig, in his *Die Blattwespen*, in which 17 species are described, with all the details of their economy and transformations. (See also Loschge, in *Der Naturforscher*, st. 22.) Mr. Dale, under the date of August 16., states, "Lophyrus rufus ♀ bred, they all pupised on June 2., and they continued to breed [emerge from the cocoon?] till September 16. (*Mag. Nat. Hist.* No. 25.)

The larvæ of the genus Lyda (Pamphilius *Latr.*) differ from those of the remainder of the family in being destitute of abdominal prolegs the body being termininated by two short points, beneath which are two longer articulated appendages, resembling the thoracic legs, but stretched backwards (*fig.* 71. 12. larva of L. hypothropica *Hartig*). These larvæ reside in society in webs, upon several kinds of fruit trees, and upon firs, the leaves of which serve them for food; each larva, moreover, spins for itself a separate case, and the whole society are covered by a roof of leaves fastened together with silk. The motions of these larvæ are curious and quite unlike those of the other species which are furnished with abdominal prolegs, having more of a sliding motion, and employing its powers of spinning silk for assisting its progress. When they descend from a leaf they let themselves down by a silken thread, after the manner of caterpillars.

One of the species of this genus lives on the pear, and emits a black fluid from the mouth when alarmed. The larva of Lyda pratensis has formed the subject of a memoir by Hapf and Schwaegrichen (*Bemerkung. über den Afterraupenfrass, &c.* Bamberg and Aschaffenberg, 1829), and that of L. erythrocephala has been described by Treviranus (in *Verhandlungen des Vereins zur Beforderung des Gartenbaues*, vol. ii.). The larva of Lyda sylvatica resides upon pear trees in a web; it is of a yellow colour with a black head, and is represented in the *Entomol. Mag.*, vol. i. pl. 1. f. 4. Hartig (pl. 9. f. 1—9.) has represented the larva and imago of another species (L. hypothropica) which feeds upon the pear.

Another species of Lyda lives upon the aspens, the larva being solitary, and inhabiting the interior of a leaf, which it rolls up into a case fastened together with silk. It makes no use of its legs in walking, but merely glides along by the contraction and elongation of of the segments of its body. For several years past I have observed one of the species of this genus (L. inanita, *fig.* 71. 9.) frequenting the garden of my residence at Hammersmith, and regularly making its

appearance, in the winged state (despite of the variations of the seasons) in the last week of May. I have also found, later in the year, on the rose bushes, specimens of the larvæ of a Lyda (which I do not hesitate to regard as those of L. inanita), each enclosed in a portable case, formed of bits of rose-leaves arranged in a spiral coil (*fig.* 71. 1.). De Geer has figured various species of this genus in his 40th plate; but the synonymy appears impossible to be traced correctly. His figure 15. and Réaumur's fig. 7. pl. 15. vol. iv. represent the twigs and leaves of a pear tree spun together by the larvæ, most probably, of L. hortorum.

In general, the larvæ of these insects arrive at the full size at the end of the summer, when they descend from the leaves into the ground, in order to pass the pupa state, having previously inclosed themselves in a hard cocoon, in which they occasionally introduce grains of earth. Some species, moreover, defend themselves by spinning an internal cocoon of a finer texture than the exterior.

Some species, however (Cimbex, Lophyrus, &c.), attach their cocoons to the branches or twigs of the trees on which they have been reared; and, as they remain in this state throughout the winter, they are easily perceived when the leaves have fallen.

It is in these cocoons that the insects ordinarily pass the winter; some as pupæ (*fig.* 69. 13. pupa of Trichiosoma lucorum, *fig.* 70. 11. pupa of Cimbex), but many as unchanged larvæ. The perfect insects appear at the beginning of the following summer, gnawing a hole through the hard cocoon with their jaws. Mr. R. H. Lewis has published a very interesting notice of the habits of the perfect female of Perga Lewisii *W.*, a native of Hobarton, Tasmania (Van Diemen's Land). This insect deposits its eggs in a longitudinal incision, between the two surfaces of the leaves of a species of Eucalyptus, adjoining the mid-rib; they are placed transversely, in a double series, and are in number about eighty. On this leaf the mother sits till the exclusion of the larvæ; and as soon as these are hatched, the parent follows them, sitting with outstretched legs over her brood, protecting them from the attacks of parasites and other enemies with admirable perseverance. These observations were made upon insects at large. (See, further, *Trans. Ent. Soc.* vol. i. p. 233.)*

* In a subsequent communication, with which I have been favoured by Mr. Lewis, he states, "I did not succeed in rearing these larvæ, nor am I yet acquainted with the male insect; but I have had another opportunity of confirming my observ-

The perfect insects are of moderate size; some, however (Cimbex, &c.), are amongst the largest species of Hymenoptera inhabiting this country; they do not, however, much exceed an inch in length. They are ordinarily of dark colours, varied more or less with pale markings of white, red, or yellow. Their flight is, in general, heavy, and attended with a humming noise in the larger species. Those of the genus Lyda, however, are exceedingly agile in the hot sunshine. The males, in some species, are very fierce; and I have observed two male Trichiosomæ lucorum fighting and biting each other violently. The species seem, for the most part, inhabitants of moderate climes, very few species being received from the tropics. There is considerable difference in the appearance of the sexes of some of the species; and in some the males are met with abundantly (as in Abia), whilst in others the females are far more abundant (Zaræa). Mr. Curtis has figured a singular gynandromorphous individual of Tenthredo (Strongylogaster) cingulata *Fabr.*, in which the opposite sides are not symmetrical, the right half being feminine, and the left masculine.

The number of parasites which subsist upon these insects is very great, many species attacking the same species of saw-fly: thus, Hartig gives a list of twenty parasites of Lophyrus Pini, fifteen of which are Ichneumonidæ.

They are chiefly vernal; they frequent nectariferous and polliniferous plants in the greatest abundance, especially those of the Umbelliferæ, obtaining their chief supply of food from the pollen or nectar-like syrup of the flowers. Various species, however (T. viridis, scalaris, &c.), attack and devour living insects which frequent the same plants, as observed by St. Fargeau (*Ann. Soc. Ent. de France*, 1834, p. 11.), and Dahlbom (*Prod. Hym. Scand.* p. 38.).

Amongst the various insects collected by Mr. Raddon from raw turpentine, were many specimens of two large new species of Lydæ, which had evidently lost their lives from having been attracted to the

ations, and I shall use every endeavour to breed the male this season. There is but one brood in the year; and it is somewhat singular that the earliest portion of their lives is passed in our winter, when we are subject to heavy rains. When resting in the day, the larvæ, like most other Terebrantiæ, carry their heads erect; on their mouths is a drop of yellow gummy fluid, and, if touched, they throw their heads back, and vomit this in some quantity [thus materially differing from the larvæ of the Cimbices]. It is very thick, and seems to be given them as a protection against Ichneumonidæ, one of which tribe preys upon them; and I have seen it dead, with the wings and legs covered and glued together by the gummy matter."

turpentine, when flowing from the wounded fir trees. I remarked, however, as a curious circumstance, that all these individuals were males.

In the perfect state many of these insects exhibit various interesting structural peculiarities; thus, Cimbex and its allies have clavate antennæ; in Hylotoma these organs are apparently composed of a single inarticulated joint, two very short basal joints being alone observable; the males of Schizocerus *Leach* have each of the antennæ formed of two long equal branches; those of Cladius have these organs slightly branched on one side, whilst they are deeply biramose in Lophyrus; in Lyda the antennæ are slender, setaceous, and multiarticulate; whilst in Cephus they are thickened at the tips and multiarticulate. In Tarpa the lower parts of the mouth are considerably elongated, so as to form an haustellum.

The genus Xyela *Dalm.* (Pinicola *Brebisson*, Mastigocerus *Klug*, *fig.* 71. 13. Xyela pusilla ♀) is one of those anomalous forms which so much perplex systematists. The general form of the head and body is not materially unlike that of Lophyrus or Lyda, but the antennæ are singularly constructed, being 13-jointed; the basal joint, overlooked by Dalman and Curtis, being small and obconic; the second longer; the third short; the fourth forming a long, robust, and cylindric stem, equalling or exceeding the nine terminal joints in length, which are short and slender; the terminal joint very small in X. pusilla, but as large as the preceding in X. Dahlii *Klug*, a species for both sexes of which I am indebted to Dr. Klug. The jaws are robust and unevenly toothed (*fig.* 71. 15.); the under jaws are minute and membranous; the inner terminal lobe truncate and setose; the external (according to Curtis) being terminated by a smaller one. Hartig, however, describes the outer lobe as terminating in two conical lobes. The maxillary palpi are greatly elongated and elbowed, so as to resemble a pair of short legs arising from the mouth; they appear to be 4-jointed, and are so described by Dalman and Curtis; but Hartig states that the terminal joint is terminated by three minute fleshy joints, preceded by a constriction of the fourth joint. (*Hart.* pl. 6. f. 30.) In X. Dahlii, these organs appear to me to be only 6-jointed, and their appearance is represented at *fig.* 71. 17. The labium is represented as porrected between the labial palpi by Dalman; and Hartig states it to be 3-lobed (*fig.* 71. 18.); but Curtis has entirely overlooked it. The labial palpi are short, and described by Dalman as 3-jointed, and

by Curtis as 4-jointed; but Hartig states that there is only a constriction, and not a distinct articulation, between the third and fourth joints. The cells of the wings are numerous; they have been described as having three marginal and two complete submarginal cells; and such is their appearance in X. pusilla; but an examination of the wing of X. Dahlii (*fig.* 71. 16.) will enable us to form a more correct notion of the analogies of these cells. The ovipositor of the female is exserted, and as long as the abdomen; it is inclosed between two compressed externally pilose lamellæ, and is membranous, with a strong horny central rib. From the descriptions of Dalman and Curtis, it would appear to consist only of a single piece; but I have ascertained that, in X. pusilla, it consists of two plates (*fig.* 71. 14. extremity of abdomen of ♀, with the saws extended), very slightly serrated, and thus agreeing in its composition with the saws of the other Tenthredinidæ. The anterior tibiæ have two apical calcariæ (*fig.* 71. 19.); the posterior tibiæ have two bristles on the external edge in the middle, although described by Curtis as having only one spine at the tips. Latreille, under this genus, states, "les larves vivent dans l'intérieur des végétaux, ou dans les vieux bois." (*Règne An.* 2d ed. tom. v. p. 277.) Dalman considered this genus to belong to the Siricidæ (Uroceridæ); Curtis, although noticing that it beautifully unites the Tenthredinidæ with the Uroceridæ, and that in its ample wings and large stigma it bears considerable resemblance to Lyda, adds (in consequence of his not being acquainted with the true structure of the ovipositor), that "it cannot be denied that the compressed oviduct brings it close to Xiphydria;" he accordingly placed it in the family Xiphydriadæ *Leach.* Dahlbom, on the contrary, unites it with the family Tenthredines, as well as Hartig, who places it at the end of the family. The curious little genus Blasticotoma Filiceti *Klug* appears to me to be allied to Xyela in the structure of the antennæ, although the terminal joints are obsolete.

The genus Cephus *Latr.* (Trachelus *Jur.*, Astatus *Klug*) is as anomalous as Xyela, and equally serves to connect the Tenthredinidæ and Uroceridæ. The antennæ are multiarticulate (21—28-jointed)*, generally thickened towards the tips (*fig.* 71. 25.); the mandibles are robust and strongly and irregularly toothed; the labium is divided into 3 elongated lobes (*fig.* 71. 21.); the labial palpi are 4-jointed, the joints being irregular in size; the maxillæ are bilobed, the outer lobes being

* They have been described as only 21-jointed by Klug, Hartig, &c.; but in the subgenus Phylloecus *Newm.* they are 28-jointed, and filiform.

the largest, and pilose; the maxillary palpi long, slender, and 6-jointed; the four basal joints gradually increasing in length; the fifth very minute, and the last as long as the third (*fig.* 71. 20.). Like the Uroceridæ, the calcaria of the anterior tibiæ are single (*fig.* 71. 22.); but each of the tarsal joints is furnished with a minute membranous lobe beneath. The intermediate tibiæ have also one, and the posterior tibiæ, two spurs towards the middle (*fig.* 71. 23.), which, together with their multiarticulate antennæ, indicate a relation with Lyda. The collar is elongated, as in the Uroceridæ; the ovipositor consists of two compressed plates, nearly straight, and serrated, but formed as in the true saw-flies, defended by two external 2-jointed sheaths (*fig.* 7. 24. apex of abdomen of Cephus ♀ with the saws extended).

The larva of the typical species C. pygmæus (Sirex pygmæus *Linn.*) resides in the interior of the stems of wheat, and occasionally commits much injury. A memoir was published upon this insect by Bosc (*Bull. Sciences Nat.* No. 5. 1823, and see *Philos. Mag.* August, 1823,) in which various means were suggested for its destruction. The larva is figured by Guérin (*Iconogr.*). Another species (C. abdominalis, *Latr.*) is stated by Latreille to live upon the flowering buds of fruit trees, and do them a great deal of mischief. M. V. Audouin has, however, informed me that it deposits its eggs on the young shoots of the pear in a spiral direction, and that the larva feeds within the slender shoots. (*Aud. MSS. Obs.* 1835, No. 9.) The larva (*fig.* 71. 26., copied from Audouin's highly magnified drawing) is fleshy, with a scaly head, and six thoracic minute legs, but destitute of anal prolegs; the abdomen has the terminal segment attenuated and terminated by two minute points; there is also a minute conical lobe near the base on each side of this segment. The situation of this genus has been the subject of much discussion. Dr. Leach placed it in his family Xiphydriadæ, and Klug and Hartig amongst the Siricidæ; the latter being influenced by the form of the collar, saws, and anterior calcaria. Latreille united Xyela, Cephus, and Xiphydria into a distinct section at the end of the Tenthredinidæ. Curtis, from the form of the labium, elongated palpi, and spurred posterior tibiæ, arranged it with Tenthredinidæ; which I certainly deem its most natural relations, having more especially regard to the form of its larva and that of Lyda.

The distribution of these insects had been attempted by various authors; Leach, Klug, St. Fargeau, Dahlbom, and Hartig having devoted much attention to this branch of the subject. Geoffroy first

separated the species with clavate antennæ (or Cimbices), under the generic name of Crabro, which has since been applied to very different insects. Fabricius added five other genera, and Jurine four. Leach divided the family into nine stirpes, founded chiefly upon the form of the antennæ, and the number of cells in the wings; and added several other genera. St. Fargeau proposed another artificial distribution, founded entirely upon these two characters. The arrangement proposed by Latreille in the second edition of the *Règne Animal* appears far more natural as regards the affinities of the genera. The arrangement proposed by Dahlbom is confined to the species of Scandinavia, and that by Hartig to the German species; so that we cannot gain a knowledge of their views as to the arrangement of the exotic groups, as Pterygophorus, &c.* By combining the different most nearly allied genera together, it appears to me that the family is divisible into the following subfamilies: —

1. *Cimbicides.* — Antennæ short, clavate, with not more than eight joints; larvæ 22-footed, emitting drops of viscid matter from the pores of the body. (Cimbex, Perga, &c.)
2. *Hylotomides.* —Antennæ 3-jointed, terminal joint greatly elongated; labrum apparent; larvæ 18- to 20-footed, not emitting drops of viscid matter. (Hylotoma.)

The genus Athalia seems to be the connecting link between this subfamily and the next.

3. *Tenthredinides.* — Antennæ 9- to 14-jointed, simple, filiform to the tip; labrum apparent; saws with parallel sides. (Tenthredo, Nematus, Dolerus, Selandria, &c.)
4. *Lydides.* — Antennæ multi-articulate, sometimes strongly pectinated in the males; posterior tibiæ often spined in the centre; labrum minute; saws but slightly serrated at the tip, strongly dilated and elbowed at the base (*fig.* 71. 10. saw of Lyda); larvæ various.

The anomalous genera Lyda, Tarpa and Lophyrus agree in these last characters; and I cannot but think that those afforded by the form of the ovipositor (which have not been previously employed in the distribution of this family) are of primary importance; in which respect

* These two authors have adopted a plan which appears to me to be likely to lead to much confusion; the genera, subgenera, sections, and tribes being all named as genera: thus the Tenthredo melanocephala *Fab.* is named Tenthredo, Selandria, Blennocampa, Monophadmus, melanocephala, by Hartig.

Lophyrus bears but little relation to Hylotoma or Cladius, near which it has been ordinarily arranged.

The genera Cephus and Xyela, and probably also Blasticotoma, appear to be respectively types of separate subfamilies. Xyela, in the size of its wings, approaches nearest to Lyda. Perga has a long and strongly serrated saw, whilst that of Pterygophorus is more like that of Lophyrus.

The second family, UROCERIDÆ* *Leach* (Siricidæ *Curtis*), corresponding with the Linnæan genus Sirex†, is distinguished from the preceding insects by the structure of the ovipositor or borer, the irregularity in the trophi, the entire labium, the existence of a single spur on the fore tibiæ, and the elongated prothorax and collar. The body is of an elongated parallel and nearly cylindric form, the males being more depressed (*fig.* 72. 8. Urocerus juvencus ♂). The head (*fig.* 72. 9. front of head of ditto) is rounded, and about as broad as the thorax; the eyes somewhat kidney-shaped; the antennæ filiform or setaceous, vibratile, and composed of from 10 to 25 joints.‡ The

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* BIBLIOGR. REFER. TO THE SIRICIDÆ.

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Foggo. Note of an Insect of the Genus Urocerus, in Edinburgh Journal of Science, vol. ii. 1825.

Guérin, in Mag. Zool. 1833. Ins. No. 68. (Urocerus Lefebvre.)

Latreille. Mémoire sur un Nouv. Genre d'Insectes (Orusse) présenté à l'Institut National le 28 Floréal, An 4. — Ditto, in Encycl. Méth., tom. viii. p. 561. (Oryssus, new sp.)

Westwood, in Zool. Journ., vol. v. p. 440. (Oryssus Sayii.)

Newman, in Ent. Mag. No. 4. p. 415. (Urocerus — *Sirex.*) — Ditto, in ditto, No. 25. p. 486. (Oryssus, new sp.)

Shuckard, in Mag. Nat. Hist., New Series, vol. i. p. 630. (U. duplex.)

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† The genus Urocerus was established by Geoffroy in 1762, four years previous to the publication of the twelfth edition of the *Systema Naturæ,* in which Sirex was proposed by Linnæus, who incorrectly referred to Geoffroy's Urocerus under the name of Uroceros. Stephens adopts the family name Uroceridæ from Leach, but follows Linnæus and Fabricius in using the name Sirex. The French authors properly retain that of their countryman Geoffroy.

‡ In the genus Urocerus, the number of joints in the antennæ differ in the different species. In Urocerus gigas ♀ the antennæ are 24-jointed, the two terminal

Fig. 72.

upper lip is minute and elongated; the mandibles short, but very strong and horny; the lower parts of the mouth vary considerably in their form. In Urocerus they are very anomalous and minute; the maxillæ are two elongated setose lobes, united by membrane at the base, with very short exarticulate (biarticulate? Curtis, and in Klug's *Monogr.* section i. tab. 8. fig. 18. from S. gigas) palpi (*fig.* 72. 10. from S. juvencus ♂). The lower lip in this genus is attached upon the membrane connecting the base of the maxillæ (*fig.* 72. 11.); the mentum is transverse, and broadest in front; the labium is produced between the palpi, which are short and 3-jointed in S. juvencus, whilst they are 2- or 4-jointed in other species, according to Klug, who, however, as Latreille justly observes, did not understand the peculiar construction of these organs, judging, at least, from the figures given in his *Monogr. Siricum*. Latreille, indeed, states that he regards the maxillary palpi as 2-jointed and the labial as 3-jointed in all the species. (*Gen. Cr.*, &c., tom. iii. p. 240. note.) The anterior tibiæ are furnished with a single spur at the tip (*fig.* 72. 12.), and the males have the hind legs flattened. The prothorax is elongated beneath into a short neck, the collar being broad and elevated; the mesothorax is large, and the metathorax composed of two distinct dorsal parts, the anterior of which is furnished with two cenchri, and the posterior

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joints being closely soldered together; in U. juvencus ♂ they are 18- and in the ♀ 19-jointed. I possess males of the latter species in which they are 19-jointed, and others in which they are only 17-jointed. Latreille places U. gigas in the section with 25-jointed antennæ, and U. juvencus in that with 21- to 23-jointed antennæ. (See further hereon, Kirby, *Mon. Ap. Angl.*, vol. i. p. 219.)

(hitherto regarded by all authors as the basal segment of the abdomen) having a longitudinal impression down the middle. The abdomen is perfectly sessile, somewhat flattened in the males of Urocerus, but cylindrical in the females: in both sexes, the terminal segment is produced into a point; but it is much stronger, larger, and more horny in the females: in the latter, on the under side of the terminal segment, is an impression which has been mistaken by Latreille for the anus. The construction and real nature of the instrument of oviposition or borer of these insects has not been satisfactorily investigated; but which, from the peculiarity, structure, and habits of this osculant group of insects, is so necessary for affording proofs of the relation of the saw-flies with the other Hymenoptera. My *fig.* 72. 13. represents a lateral view of the extremity of the abdomen of the female Urocerus juvencus, exhibiting, at *a*, one of the two minute pilose styles (hitherto unnoticed by any previous author), and which we have seen to exist in the Tenthredinidæ; *b* represents the basal and *b b* the terminal division of the outer horny flattened sheaths of the ovipositor, which in U. spectrum are nearly as long as the body. Between these sheaths, when at rest, lies the boring instrument c, a long horny piece which is nearly cylindrical and hollow, but incloses in its lower cavity two horny spiculæ*, having a separate motion from that of the borer itself. *Fig.* 72. 16. represents a transverse section of this compound instrument; c being the borer, consisting of a horny cylinder, with lateral impressions c ×, and channelled on the under side for the reception of the two spiculæ, *c* and *c*. *Fig.* 72. 14. represents a small portion of the base of the under side of these instruments, showing the dilated root of the borer itself, c o, and of the two spiculæ, *c o*: these spiculæ are slightly grooved at the base: one of them is here represented as propelled forwards by a muscle; in which case, of course, its point would extend beyond the point of the borer, the spiculæ and borer being of equal length; at *e* is a groove in the oblique edge of the borer, which seems to receive a slight rib in the spicula. *Fig.* 15. represents the extremity of the borer c, part of it being broken off, in order to show the separation between it and the spicula *c*, which is strongly toothed at the tip, or its under side; and c × represents the lateral impressions of the borer (as in *fig.* 16. c ×), forming a strong lateral serrature. On comparing these details

treille incorrectly describes the terebra as "bivalvulata." (*Genera Cr.*, p. 242.)

with those of the saw-flies (*fig.* 70. 12—19.), we are at once struck with the relations existing between several of their parts; the minute style (*a*) and the 2-jointed outer sheaths (*b* and *b b*) are perfectly analogous, so that we are at once led to the opinion that the borer of the Urocerus is but the saw of the Tenthredo, modified to fit it for its functions. The Tenthredinidæ ordinarily oviposit in the soft substance of leaves, and their saws are accordingly of a delicate structure; but the Uroceridæ deposit their eggs in sound timber, and have need of a far more powerful instrument. In order, therefore, that their instrument of oviposition should possess sufficient strength, it is not only horny, but the two compressed back supports of the saws of the Tenthredo are soldered together into a cylinder c, which, both as regards its situation with the spiculæ, and its action as a support to them, cannot but be analogous to these supports. The two spiculæ of the Urocerus, on the other hand, are clearly analogous, both in action and almost in their serrated structure, with the sawing parts of the two saws of the Tenthredo. Burmeister, indeed, first correctly describes the superior channel of the terebra as including a double bristle; but, as we shall see that there is a precise analogy between the borers of Urocerus and Ichneumon, we cannot adopt Burmeister's view (*Manual*, p. 198.), that the upper half tube (c) is formed of the two entire saws of the Tenthredo, and that the lower part of the terebra (or the two spiculæ) is an elongation of a small triangular plate which exists at the base of the saws of the Tenthredo.

With this powerful boring apparatus the females are enabled to deposit their eggs in timber, especially preferring the various kinds of firs. The larva of Urocerus Gigas has been figured by Rösel, and that of U. juvencus by Hartig. I am indebted to Mr. Raddon for an opportunity of examining one of the latter (*fig.* 72. 17.). The larvæ are long, cylindrical, fleshy grubs, with the segments transversely plicate: the head (*fig.* 72. 18.) is small and horny, destitute of eyes, but furnished on each side, above the jaws, with a minute conical antenna, articulated, as it appears to me, both at the base and extremity (*fig.* 72. 19.), although represented by Hartig as exarticulate; with the exception of the jaws, the parts of the mouth are small; the upper lip arises from a distinct transverse clypeus; it is transverse, with the anterior angles rounded off, and emarginate in the centre. The mandibles are horny, quadrate, one being depressed and the other com-

pressed, terminated by three or four nearly equal teeth, and furnished with a large horny lobe (*fig.* 72. 20.). The action of these jaws must be remarkable, because the acute edge of one is brought into contact, when at rest, with the broad extremity of the other. The maxillæ are small, and terminated by three lobes; the inner one is oval and strongly setose; the outer one is very minute and exarticulate; whilst the intermediate one, which appears to me to be the analogue of the palpus, is broad at the base, and terminated by a small narrower part, which I believe to be articulated both at its base and in the middle (*fig.* 72. 21.). The figures given by Hartig of this organ (tab. 8. fig. 26. *b.*), give no notion of its true form. The lower lip is fleshy, transverse, and produced considerably within the mouth; it is provided at the sides with a pair of minute 3?-articulate palpi (*fig.* 72. 22.). Each of the three anterior segments of the body is furnished with a pair of minute exarticulate legs. The abdominal segments are destitute of prolegs, which are replaced by fleshy protuberances, and the terminal segment of the body is large, and armed with a horny point.

In the larva state these insects reside in the interior of trees, which they perforate in various directions, often causing great destruction in the pine forests, of which the larger species are inhabitants.* When full grown, these larvæ are stated by some authors to form a slender silken cocoon, mixed with chips of wood and excrement, at the end of their burrows, and in which they undergo their final transformations. The pupa greatly resembles the imago, having the limbs laid along the sides of the body and breast. When the transformations of the insect take place in the summer, the imago is produced in the space of a month; but if the larvæ are not full grown until autumn, the fly does not appear until the following summer.

The perfect insects are amongst the largest in the order, and make a considerable humming on the wing, like the humble bee; whence Mr. MacLeay, who formed them into an osculant order, between the

* Mr. Raddon forwarded to the Entomological Society specimens of U. Juvencus, accompanied by specimens of the wood of a fir tree from Bewdley Forest, Worcestershire, perforated by this insect. Of this tree, 20 ft. were so intersected by the burrows, that it was fit for nothing but fire-wood; and being placed in an outhouse, the perfect insects came out every morning, five, six, or more each day. The females averaged one in twelve for the first six weeks, but afterwards became more plentiful, and continued to make their appearance until the end of November, females only being produced during the last two or three weeks. (*Trans. Ent. Soc.*, vol. i. p. 85. App.)

Hymenoptera and Trichoptera, named them Bomboptera. As the larvæ generally reside in fir timber, the insects are imported into this country, and consequently often make their appearance in the perfect state in newly built houses, having undergone their transformations in the timber employed in their construction.

Some species, in Germany, have occasionally appeared in such numbers as to raise alarm in the minds of the ignorant. They have also been regarded as the species of insects recorded (in the *Abhandl. der Kaiserl. Acad. der Naturforscher*, 9 th. p. 252., 14 th. p. 82.) as having stung many men and beasts to death in and near the town of Czierck. (See Griffith's *An. K.*, part xxxiii. p. 404.) Dr. Klug has been at some pains, in his *Monographia Siricum Germaniæ*, to eradicate this unfounded assertion, considering the account given in that work to be fabulous.

The sexes of these insects vary considerably in their colour and form, particularly in the abdomen and legs, and have hence been described under different names. The species are few in number, and of considerable rarity in this country. They frequent mountainous districts, especially those clothed with fir forests. Like all Xylophagous insects, they are also subject to the greatest variation in size, some individuals not being one third the size of others.

The Count de Saint Fargeau has informed me that he considers these insects to be parasites, like the Ichneumonidæ, and that it is upon Xylophagous larvæ, and not upon wood, that the larvæ subsist; and in the *Encyclopédie Méthodique*, tom. x. p. 770., he has noticed that "les débris que nous avons trouvé auprès de sa coque, tels qu'une tête écailleuse que nous a paru très distinctement être celle d'une larve de Coléoptère," seemed to confirm this idea. The accounts, however, which have been furnished by so many authors, and especially by the Germans, who have abundant opportunity of observing these insects, leave no doubt of their Xylophagous habits; and the description which I have given of the head of the larva of U. Juvencus would easily cause it to be mistaken for that of the larva of a beetle.

Further notices of the destruction caused by these insects in fir plantations are contained in Curtis, *Brit. Ent.*, fol. 253.; Kirby and Spence, vol. i. p. 212.; Marsham, in *Linn. Trans.*, vol. x. p. 403.; Kirby, in ditto, vol. v., ditto, vol. xiv. App.; Rossmassler, Kollar (*Forstinsecten*). (See also De Geer, vol. i.; Reaumur, vol. v.; Hartig, Latreille, &c., for further structural details of these insects.)

The genus Xiphydria *Latr.* (*fig.* 72. 4. X. Dromedarius ♀) has been the subject of much confusion as regards its relations. Linnæus united it with Sirex; and Klug introduced it, with Cephus and Orysus, into his *Monographia Siricum.* Latreille, however, always placed it, with Lyda and Cephus, as a distinct terminal section of the Tenthredinidæ; remarking, however, "Xiphydriæ Cephique corporis forma, oviductu exserto, elongata, cum Tenthredinetis et Uroceratis ambigentes, ad familiam secundariam accedere videntur" (*Gen. Cr. &c.* vol. iii. p. 238.), which evidently induced Leach, followed by Stephens, to form Xiphydria, Cephus*, and Xyela into a separate but inaccurately characterised family, Xiphydriadæ. The discovery of its preparatory states enables me to prove its connection with Urocerus; although, like Cephus and Xyela, it serves, in its perfect state, to form the passage between the two families Tenthredinidæ and Uroceridæ. The mandibles are small, like those of Urocerus; but the lower parts of the mouth differ from that genus, as well as from any of the saw-flies. The maxillæ (*fig.* 72. 5.) are elongated, and terminated by two membranous lobes; the maxillary palpi are 5- (not 4-) jointed; the basal joint being minute but distinct, the second very long and slender, and the three terminal joints short. Compared with the maxillary palpi of the Tenthredinidæ, these organs are small and weak. The labium (*fig.* 72. 6.) is elongated and membranous; and it appears to me to be entire, although Hartig figures it as deeply trifid (pl. 8. fig. 11.), as in the Tenthredinidæ. (Dr. Klug also describes it as "vix emarginatum, vel potius integrum," *Mon. Sir.*, p. 12.) The labial palpi are much stronger than the maxillary, — thus proving the relation of this genus with Urocerus, — and 3-jointed. In one of the labial palpi which I examined in X. Dromedarius, the basal part of the terminal joint was constricted, and which has evidently led Hartig to figure it as 4-jointed (tab. 8. fig. 12.). The prothorax is greatly elongated, and very low, and the collar elevated, which has induced the specific names Camelus and Dromedarius. The peculiar structure of the calcaria of the fore legs and of the tarsi has been overlooked by all writers. The anterior tibiæ are terminated by a single broad curved spur (which is the peculiar character of Urocerus); although all the tibiæ are stated to be terminated by two spines, by Klug, Stephens, &c. (which is the

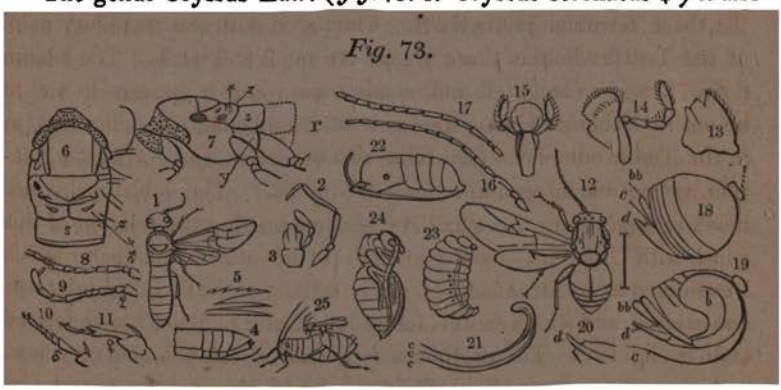
* In his *Illustrations*, Mr. Stephens has united Cephus with the Tenthredinidæ, leaving Xiphydria and Xyela alone in the family of Xiphydriadæ.

character of the Tenthredinidæ). On the other hand, each of the four basal tarsal joints is furnished beneath with *two* small pulvilli; in which respect they differ from all the other allied genera; although Latreille and Klug are silent as to the pulvilli, and Hartig states, "patellen fehlen" (p. 369.), which is the character of Urocerus. The structure of the ovipositor (terebra) is also precisely similar to that of Urocerus, and is correctly represented by Hartig * (pl. 8. figs. 13, 14, 15.). The females deposit their eggs in standing trees, in which occupation I detected a specimen of X. Camelus in the Jardin des Plantes.

In 1827, A. Cooper, Esq., R.A., communicated to me the larva and pupa of X. Dromedarius, which he had discovered in willow trees. I have represented the larva at *fig.* 72. 7.: it greatly resembles that of Urocerus; having six minute exarticulate thoracic legs, and a horny point at the tail. For various further details and figures of this insect I must refer to a separate memoir prepared at the period above mentioned, and noticed in the *Zool. Journ.*, No. 10. (1827), but not yet published.

The genus Oryssus *Latr.* (*fig.* 73. 1. Oryssus coronatus ♀) is also

Fig. 73.



exceedingly interesting in respect to its anomalous structure. The jaws are robust, like those of Urocerus; the maxillæ and labium nearly similar to those of Xiphydria, the labium (*fig.* 73. 3.) being entire, but with two slight lateral impressions; the maxillary palpi are long and 5-jointed (*fig.* 73. 2.); the antennæ are simple, and com-

* Klug and Latreille are silent as to the composition of this organ, but St. Fargeau incorrectly states under Xiphydria, "oviductorii fabrica eadem ac in Tenthredinetis, usus idem." — (*Monogr. Tenthr.* p. 2.)

posed of eleven* regular joints in the males (*fig.* 73. 8.), but consist of ten very irregular joints in the female (*fig.* 73. 9.). The anterior tibiæ in the males (*fig.* 73. 10.) are simple, but dilated and incised in the females (*fig.* 73. 11.); in both sexes they are terminated by a single spur: the anterior tarsi are 5-jointed in the males, but only 3-jointed in the females.

The construction of the thorax is represented in *fig.* 73. 6, 7., in which the prothorax and its collar are dotted, the mesothorax not lettered, and the metathoracic parts marked with letters — *z* being its præscutum, and *s* its scutellum; *x* are the cenchri, and *y* the epimeron; the femora of the anterior, middle and posterior legs are cut off at the base; and the dotted part *r*, in *fig.* 7., represents the basal segment of the abdomen. This part of the body is not pointed at the top in the females, as in the Urocerus and Xiphydria. The ovipositor is long and very slender, and has been described as spiral in its form; but this is incorrect, being strongly curved only at its base. It ordinarily rests in a channel at the under side of the extremity of the body, but is capable of being partially (as in *fig.* 73. 4.) or entirely exserted (as in Klug's *Monogr. Siric.*, tab. 1. fig. 3.). The composition of the terebra (*fig.* 73. 5. its extremity, copied from Hartig) is similar to that of Urocerus, although far more delicate; c representing the canal, and *c c* the two spiculæ of the terebra. Dahlbom has separated this anomalous genus from the Uroceridæ, and formed it into a distinct tribe, Oryssini, chiefly on account of the structure of the ovipositor, the paucity of veins in the wings, and the insertion of the antennæ beneath the clypeus, close to the mouth. He also conjectures that its larva is gallivorous.

These insects are extremely agile, running about the stumps of trees with great velocity in the sunshine. Latreille and Klug suppose that the larvæ subsist upon the wood of standing trees. Scopoli found them upon fir trees, and Latreille upon old hornbeams.

The second division of the Terebrant Hymenoptera comprises a very extensive tribe of insects, for which the name of ENTOMOPHAGA may be retained, on account of the habits of the majority of the species, the larvæ of which are parasitic upon or within the bodies of

* Fabricius and Hartig incorrectly describe the male antennæ as 12-jointed; and the latter also describes the female antennæ as 11-jointed, regarding the minute insertion as a distinct joint.

other insects. From the true aculeated Hymenoptera, to which some of the terminal species are allied, they may be distinguished by the number of the joints of the antennæ, as well as by the structure of the ovipositor. There is, however, considerable diversity in the habits of the species; some (forming a portion of the family Cynipidæ) residing, in the larva state, in galls resembling those of the gallivorous Tenthredinidæ. Other species, however, belonging to the same family, are parasites. It would also appear, from some recent observations, that some of the species of Proctotrupidæ are fossorial.

They are characterised by having the abdomen attached to the thorax by a small portion only of its transverse diameter; its basal segment being often elongated into a peduncle. The abdomen, in the females, is furnished with an elongated plurivalve ovipositor, similar in its general construction to that of the Siricidæ.

Latreille separated this division into six tribes,—Evaniales, Ichneumonides, Gallicoles, Chalcidites, Oxyures, and Chrysides. These tribes were retained by St. Fargeau, who proposed another arrangement of them, including the two preceding families (*Encyclopédie Méthodique*, tom. x.), as follows: —

I. A borer in the females. No sting.
  1. Borer of two horny pieces.
    [Fam. 1. Serrifera. (Tenthredinides.)]
    Fam. 2. Spirifera. Ovipositor spiral, retractile when at rest. (Gallicoles and the genus Oryssus.)
    Fam. 3. Terebellifera. Ovipositor partly lodged at rest in an external sheath.
      1 Tribe. Chalcidites.
      2 Tribe. Ichneumonides and Evaniales.
      [3 Tribe. Urocerates, except Oryssus.]
  2. — Fam. 4. Canalifera. Ovipositor of a single horny piece. (Oxyures *Latr.*)
II. A membranous ovipositor of a single piece. A sting.
    Fam. 5. Tubulifera. (Chrysides.)

I can neither adopt the nomenclature nor arrangement of St. Fargeau, because neither appear to have a foundation in nature; the precise construction of the ovipositor in these different groups not having been correctly ascertained, whilst we have already seen that there are no grounds for the insertion of the Uroceridæ amongst the parasitic insects. In two respects, however, St. Fargeau appears to me to have arrived at a more natural result than Latreille: 1st, in placing the gall-flies next after the saw-flies (in which respect he has been followed by

Dahlbom, who thinks that Oryssus constitutes the connecting link between them); and 2dly, in showing the relation of Evania and Ichneumon. How far it would be natural to place the Cynipidæ at the head of these groups, making the aphidivorous Cynipidæ the connecting link with the aphidivorous Adscitous Ichneumons, which should be succeeded by the genuine Ichneumons, and these by Aulacus and Fœnus, Evania conducting to the species with the wings almost destitute of nerves, can only be ascertained by a more precise and general investigation of the structure of these insects than has yet been given to them. For the present I have arranged them in the following manner, provisionally keeping Evania distinct from Ichneumon: —

I. SPICULIFERA.* — Terminal segments of the abdomen not forming a retractile tube; ovipositor furnished with two delicate spiculæ working in a horny semi-canal, which is defended at rest by two often partially exserted valves.

Fam. 1. *Cynipidæ.* — Chiefly gall-feeding insects, having the ovipositor subspiral and internal; antennæ straight, 13- to 15-jointed.

Fam. 2. *Evaniidæ.* — Parasitic insects, having the ovipositor straight, the abdomen attached to the dorsum of the metathorax, and the antennæ straight and 13- to 14-jointed.

Fam. 3. *Ichneumonidæ.* — Parasitic insects, having the ovipositor straight, the abdomen attached at the extremity of the metathorax; the antennæ straight, and with more than 16 joints (except in a very few minute species).

Fam. 4. *Chalcididæ.* — Parasitic insects, having the antennæ elbowed, and generally thickened at the tips, 6- to 13-jointed; the palpi short; the wings nearly destitute of veins; pupa naked.

Fam. 5. *Proctotrupidæ.* — Parasitic insects, having the antennæ more or less elbowed, 10- to 16-jointed; the upper wings vein-

* The difficulty which opposes uniformity in the nomenclature of the higher sections of an order is well instanced in the groups of the Terebrantia. If we employ terms founded upon the *habits* of the different families, we must introduce the gall-flies amongst the plant-feeders (Phytiphaga); if, on the other hand, we employ terms founded upon structure, we shall have the Uroceridæ separated from the saw-flies, and united with the Spiculifera, on account of the structure of their oviposit .

less, or with but very few veins; palpi generally long and pendulous; pupa inclosed in a cocoon.

II. TUBULIFERA. — Terminal segments of the abdomen telescopic and retractile; antennæ elbowed. Parasites.

Fam. 6. *Chrysididæ.*

The family of the gall-flies, CYNIPIDÆ* *Westw.* (Diplolepidæ *Leach*), corresponds with the genus Cynips of Linnæus (6th ed. of the *Syst. Naturæ*, 1748, there characterised, inter alia, by "Larva intra gallam), or that of Diplolepis of Geoffroy† (1762). These insects (*fig.* 73. 12.

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* BIBLIOGR. REFER. TO THE CYNIPIDÆ.

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Hammerschmidt. Observationes Physiologicæ-pathologicæ de Plantarum Gallarum Ortu.

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Brandt and Ratzeburg. Medizin. Zoologie. 4to.

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† Geoffroy introduced great confusion into the nomenclature of this family and that of the Chalcididæ, by employing for the latter the name given by Linnæus to the gall-flies, Cynips, and by terming these Diplolepis. The confusion was further augmented by Fabricius and the French authors. (See my article detailing the history of these groups in the 13th Number of the *Zoological Journal.*)

C. gallæ tinctoriæ) are distinguished by the gallivorous habits of the majority of the species; and by having the antennæ straight, and 13- to 15-jointed; the wings with but few nervures; the palpi short; and by the construction of the ovipositor.

The head is of small size, and transverse; the thorax thick, and of an oval form; and the abdomen much compressed, ordinarily with a very short peduncle. The antennæ are inserted in the middle of the face: they are generally of moderate length and slender (those of the females being shorter and thicker), varying in the number of joints (13 to 15) in the sexes, the males having one or two joints more than the females (*fig.* 73. 16. ♂, 17. ♀, antenna of Ibalia). The basal joint is thickened, the second very short, and the third the largest, and in the males often incised or curved; the labrum is very minute; the mandibles (*fig.* 73. 13. C. quercus folii *) are short but robust, with several teeth at the extremity, somewhat differing in the opposite jaws; the maxillæ (*fig.* 73. 14.) are elongate, horny at the base, and furnished at the extremity with a broad membranous ciliated lobe; the maxillary palpi are 5-jointed, the basal joint being very minute, and the terminal one somewhat securiform. The mentum is elongate, narrow, and horny; the labrum large, fleshy, and entire; and the labial palpi 2- or 3-jointed, the terminal joint being somewhat oval, and pointed towards the tip (*fig.* 73. 15.). The mesothorax is large; the scutellum being very prominent, and often marked with several impressions: the wings have but few veins, the anterior having two basal cells (the interior being but slightly developed), one marginal cell, and two or three submarginal ones; the second of the latter, when there are three, being very minute: the under wings have only one strong vein. The abdomen is oval and very much compressed, the basal joint being the largest, the others (generally five in number) very short and scaling one into the other; the peduncle is ordinarily very short (*fig.* 73. 18.); the ovipositor has been described as spirally convoluted, but its true composition has been overlooked by all previous writers. Reaumur, Latreille, and Burmeister have especially attempted the description of this organ; but in consequence of not tracing the analogies which the various parts present with those of Sirex, Ichneumon, &c, they have not succeeded in obtaining a correct view of its construction. On late-

Figs. 73. 13—21, 23 and 24. are from Cynips Quercus folii.

rally inspecting the abdomen of the female of C. quercus folii (*fig.* 73. 18.), the dorsal segments will be perceived to be deflexed and extended to the ventral edge of the abdomen; the venter being terminated by a pointed piece (*fig.* 18. d, *fig.* 20. d) having a canal running along its middle, which is also produced considerably beyond its front margin in the shape of a spine: this is the terminal ventral segment of the abdomen, and the canal above mentioned is intended for the reception of the capillary terebra (c) and the two valve-like sheaths (b, b). On removing the side of the abdomen (*fig.* 73. 19.), these two sheaths are found to originate in two broad curved plates (b), which are in fact the basal portion of the sheaths, the terebra itself (c) being a long and exceedingly delicate but composite seta. Burmeister is the only author who has attempted to discover the parts of which this is composed, and he describes and figures it (*Manual Transl.*, p. 199. pl. 23. fig. 15. 18.) as consisting (in addition to the two outer valves, his fig. *a*, *a*) of two external setæ (*b*, *b*), and one central very delicate bristle (his fig. *c*). It appears to me, however, upon a dissection of many specimens of C. quercus folii, that the terebra is composed, like that of Sirex, Ichneumon, Vespa, &c., of a more robust seta (*fig.* 73. c), channelled on its under side for the reception of two equal and very slender bristles (*c*, *c*), which are slightly dilated at the base, and pushed forward along the channel or gutter of the central piece, by strong muscles.

With this instrument the female insect punctures* the surface of leaves, buds, stalks, and young stems and roots of various plants and trees, increasing the aperture by the continued action of the terebra, which is stated to be denticulated at the extremity, and through which an egg is propelled into the wound of the plant, together with a small quantity of an irritating fluid, the action of which upon the plant, in some way or other, causes the production of tumours or galls of various sizes, shapes, and colours, the interior of which being of a solid substance becomes the food of the young grub when hatched. Various theories have been proposed as to the real formation of these galls, with a view to trace the means which nature employs to produce such very different kinds of galls upon the same tree from the wounds made by insects of the same genus. Hitherto, however, for want of direct observations, conjectures alone (some plausible enough) have

* *See* Bonnet, Observ. divers sur les Insectes, tom. ii. p. 257. obs. 38.

been given. (See *Insect Architecture*, p. 373. *et seq.*, wherein is contained a good summary of Reaumur's *Mémoir* with additions; Dr. Johnston's *Flora of Berwick-upon-Tweed*, vol. ii. p. 108.; *Arboretum Britannicum*, p. 1824.)

It is to Reaumur that we are indebted for a description of a great number of galls, these excrescences having formed the subject of one of his *Mémoires* (tom. iii.). (See also Rösel, *Ins. Belust.* tab. 35, 36. 52, 53. and 69.; Frisch, *Beschr. Ins.* vol. i. pt. 2. t. 3.; Swammerdam, *Hist. Ins.* pl. 45.; Vallot, *Bull. Sc. Nat.* Sept. 1830.)

Dr. Hammerschmidt of Vienna has made these galls the subject of much research, and has prepared drawings of more than 250 different species of galls, and the insects which cause them. (*Ann. Soc. Ent. de France*, vol. ii. p. 56. App.) Many of these galls are spherical; some imitating different fruits: others are hairy or tomentose, the surface emitting numerous fibrous threads; such is the gall commonly found on the wild rose, termed the bedeguar: others resemble buds, flowers, &c.; whilst a few species, found upon the surface of leaves, are flat, and have the appearance of minute mushrooms. They also differ as to the number of inhabitants found in each: thus, whilst in many species a single gall supports only a single gall insect, there are some galls (polythalamous) which serve for the residence of great numbers of individuals. An instance of this kind has been communicated to me by the Rev. W. Bree, in a gall of large size found at the root of an oak just at the surface, from which I obtained nearly 1100 specimens of C. Q. radicis. This gall was 5 inches long, and $1\frac{1}{4}$ inch broad. (This species was unknown to Reaumur, having been first described by Bosc, *Journ. de Physique*, 1794.) Such is generally the case with all the larger kind of galls, each inhabitant retaining a cell of its own. Some, however, of the size of an apple, found upon some exotic species of oaks, support only a single inhabitant.

The eggs deposited at the period of the commencement of the growth of the gall increase in size like those of the saw-flies. (Reaumur, *Mém.* tom. iii. p. 479.). The larvæ hatched from them are small fleshy grubs (*fig.* 73. 23.) without feet, but furnished with fleshy tubercles which the insects employ in their stead. These larvæ immediately attack the interior of the gall, without preventing its continued growth; remaining five or six months in this state. Others, however, assume the perfect state within the gall at the end of the autumn, but do not emerge from it till the following spring. (See

Mag. Nat. Hist. No. 15.). Some species, moreover, undergo their transformations within the gall, but others quit it when full grown, and enter the earth, there to become pupæ (*fig.* 73. 24.).

Ratzeburg has traced the developement of Cynips Rosæ, especially with reference to his theory, that the first segment of the larva (after the head) corresponds with the head of the pupa, the eyes and ocelli of which are visible through the transparent skin of the back of the first segment immediately before the insect assumes the pupa state. (*Nova Acta Natur. Curios.* vol. xvi. pl. 9. f. 22—32.)

The small round holes often to be observed upon the surface of galls announce that the insect has made its escape. Sometimes, however, these galls are found to contain a number of Chalcididæ, especially of the long-tailed kinds (Callimome), the larvæ of which have destroyed the larvæ of the true inhabitants.

Probably no insect has been of greater benefit to mankind than the Cynips Gallæ tinctoriæ *Oliv.* (*Enc. Méth.* vol. vi. p. 281.; C. scriptorum *Kirby, Introd.* vol. i. p. 319.), the galls of which are the common gall-nuts of commerce, growing upon the Quercus infectoria in the Levant, and which are employed in the manufacture of ink. The galls are of the size of a boy's marble, very hard and round, with various tubercles upon the surface; they contain but a single inhabitant, which may often be found in the interior on breaking the galls. This species resembles some of our English species which reside in globular oak-galls in its habit of undergoing its transformations within the gall, leaving a great portion of the gall unconsumed. Those galls which are gathered before the insect has escaped (and which consequently contain most astringent matter) are known in trade under the name of black or blue galls and green galls; but those from which the insect has escaped are called white galls. (Olivier, *Voy. dans l'Emp. Ottoman, and Travels in Egypt*, vol. ii. p. 61.; Hardwicke in *Asiat. Rep.* vol. vi. p. 376.; M'Culloch, *Comm. Dict.*, art. Gall; Stephenson and Churchill, *Med. Botany*, vol. iv. pl. 152.; *Athenæum*, April 15, 1837; *Arboretum Britann.* p. 1931.; Deyeux, *Mém. sur la Noix de Galle in Annales de Chimie*, April, 1793.)

Another species of these insects produces a gall the real nature of which has given rise to great controversy among the commentators upon the Bible and Oriental literature. These galls are as large as moderate sized apples, which they much resemble, and are found upon a low species of oak (Q. infectoria), which grows upon the borders of

the Dead Sea, whence they have been named Mala sodomitica, Poma insana, mad apples, &c. The existence of these

> "Dead Sea fruits that tempt the eye,
> But turn to ashes on the lips"—(*Moore*)

has been denied by some authors, who fancied them to be the inventions of Eastern fable. Tacitus, Strabo, and Josephus all mention them; and their nature has been described by Walter Elliot, Esq. (*Trans. Ent. Soc.* vol. ii. p. 14.), where I have collected the various opinions which have been entertained respecting their production, and which is now ascertained to be owing to a species of Cynips. Olivier, followed by Mr. Lambert (*Linn. Trans.* vol. xvii. p. 445.), considered these galls and the Cynips which produces them as identical with the gall-nuts of commerce; but such is certainly not the case. I have, therefore, proposed the name of Cynips insana for the inhabitant of these Poma sodomitica. (See further, *Arboretum Brit.* p. 1931.) Olivier has described another species of gall found upon the Quercus pyrenaica which is as large as the Mala insana, which it considerably resembles, and which is produced by Cynips umbraculus *Oliv.*, Cynips Q. Tojæ *Fab.* (*Journ. d'Hist. Nat.* vol. ii. pl. 32. and *Arb. Brit.* p. 1843.)

Another species of gall has occasioned much controversy, having been regarded by many writers as a parasitical species of plant (*Gard. Mag.* xi. 691.). They are small, reddish, circular, flattened insular scales, found on the under side of the oak-leaves, attached by a very short peduncle, smooth on the side of the leaf, but pilose externally. The Rev. W. T. Bree has termed them oak spangles (*Gard. Mag.* xii. 496.). Nees von Esenbeck (*Hym. Monogr.* ii. 266.) and Reaumur were unable to form any notion as to the production of these galls. The former author notices that they are parasitically attacked by an Eurytoma, and the latter calls them "galles en champignon," and states that he had often found *beneath* the gall, specimens of a minute larva. I have repeatedly found these larvæ (which appear to me to be dipterous) in the month of September; I have figured them in the *Arboretum Britannicum*, p. 1827. fig. 1652. Olivier (*Encyclop. Méthod.*), however, and more recently Mr. F. Smith, in a memoir, read before the Entomological Society, have ascertained that these galls are produced by Cynips longipennis *Fab.* (Dipl. lenticulatus *Oliv.*); but as the developement of the insect does

not take place until the month of March, long after the leaves have fallen, the real economy of this species had been overlooked.

Cynips aptera resides in galls at the roots of the oak, beech, &c. and is infested by a beautiful species of Callimome (C. subterraneus *Curtis.* B. E. 552. See Bird in *Ent. Mag.* vol. ii. p. 43.) My specimens of the galls of this species are pear-shaped, and slightly imbricated, being attached close together by their narrow end to the slender twigs of the root of the tree. They are monothalamous, and about one third of an inch in diameter.

These different galls are found upon various species of oaks, and it is to be observed that no tree affords so many distinct species of galls as the various species of the genus Quercus; the leaves, in addition to the small flat spangle galls produce globular galls of various sizes, caused by several different species; the young shoots produce a large gall, well known to schoolboys as the oak apple, and produced by Cynips terminalis; the parts of fructification are sometimes attacked by a species, the galls of which hang on the catkins like a bunch of currants; the root produces a large woody gall, inhabited by Cynips aptera; other galls are prickly, some are branched, and some resemble little artichokes. Someleaves are loaded with little rough galls, &c.

C. quercus folii *L.*, C. q. baccarum *L.*, C. q. inferus *L.*, C. q. petioli *L.*, C. q. ramuli *L.*, C. q. corticis *L.*, C. q. gemmæ *L.*, C. q. pedunculi *L.*, C. q. calicis, and C. q. terminalis *Fab.*, are all inhabitants of the oak, their names implying the different parts they affect. But see Spinola (*Ins. Ligur.* vol. ii. p. 157.) as to the impropriety of some of these names.

Of the exotic species of galls, little has been hitherto observed. M. Bosc, indeed, described sixteen species of galls, during his residence in Carolina, eight of which were found upon oaks; but he was unable to rear any of the inhabitants: one of these galls, found on the red oak, is spherical, muricated, and very downy; but the moment it is touched its hairs sink down and no more assume their former position. Another gall, of the size of a pea, found on another species of oak has the outer surface very thin, and encloses in the interior a small ball of the size of a grain of millet which rolls about, and within which the larva is lodged. M. Bosc opened hundreds of these galls without being able to learn the true nature of this production.

Dr. Dickson, F.L.S., has communicated to me some pods of the medicinal poppy, very much injured by the attacks of a species of this

family, the thin layers between the seed vessels being converted into a solid mass and the pods distorted. Bouché has described this species under the name of C. rhocados *Klug* (*Naturg. Ins.* 164.).

Another species, C. frumenti, is destructive to wheat, as described by Dumont Coursier (*Mém. Boulogne sur Mer*, and in *Wied. Archiv. für Zool.* vol. ii. st. 1.); and I have described and figured a species which infests the turnips (Eucoila rapæ *W.*, in *Mag. Nat. Hist.* vol. viii.); but Mr. Walker states that the species of the latter genus are parasites.

The relations of these insects with the following families have been already noticed. It had always appeared to me contrary to nature that a tribe of vegetable-feeding insects should be arranged in the midst of parasites; nor was it until I had an opportunity of ascertaining the parasitic habits of some of the species of the family that I was enabled to form a just notion as to the true value of the parasitic or herbivorous character of these insects. In June, 1833, I detected a minute species (Allotria Victrix) in the act of ovipositing in the body of a Rose aphis (*fig.* 73. 25.); and I subsequently succeeded in hatching specimens of the perfect insect from infested aphides. I have described the proceedings of this parasite in the *Mag. Nat. Hist.* vol. vi. p. 491. It is specifically distinct from the Cynips erythrocephala of Jurine, which species Haliday says also infests the Rose aphis; whilst C. fulviceps *Curtis*, and another, destroy the aphides of willows, cow-parsnip, &c. (*Ent. Mag.* vol. ii. p. 102.).*

Mr. Newman subsequently described a species of Figites, the larva of which is parasitic upon the larva of Syrphus ribesii (Figites syrphi, *Entomol. Mag.* vol. ii. p. 515.). Costa has also described a parasitic Figites in his Memoir upon the insects which injure the olive (*Bull. Sc. Nat.* Sept. 1830).

Bouché has described a species of Figites parasitic upon the pupa of a species of Muscidæ belonging to the genus Anthomyia (*Naturg. der Ins.* p. 165.).

The genus Anacharis of Dalman is distinguished by the great length of the abdominal peduncle, which gives these insects an appearance quite unlike that of the rest of the family. I have described several new British species belonging to this genus (*Mag. Nat. Hist.* vol. vi.). Such is also the case with Leiopteron, figured by Perty

* The *Cinips de l'Ichneumon des Pucerons* of Geoffroy, vol. ii. p. 305., referred to by Haliday (*Ent. Mag.* vol. ii. p. 99.) as Cynips aphidum, is one of Chalcididæ.

amongst the Fossores, which I have refigured with details from a specimen in the Berlin Museum, proving it to belong to this family (Guérin, *Mag. Zool.* pl. 179.).

The curious and exceedingly rare British genus Ibalia is distinguished by the long and very compressed sabre-shaped abdomen which is terminated in the females by a recurved slender terebra (*fig.* 73. 22.); the hind legs, and especially the basal joint of the tarsi, are disproportionately long and broad; the 5th dorsal segment of the abdomen is furnished on each side with a spiracle. One species only was known of this genus until I described a second from the Berlin collection, and I am acquainted with another species from Georgia.

The family EVANIIDÆ* (Evaniadæ *Leach*) is of small extent, but comprises insects of very peculiar structure, and which it will probably be necessary to separate into other groups. They may, however, be distinguished by the following characters:—The antennæ are filiform or setaceous, not elbowed, and 13 or 14-jointed; the mandibles are toothed on the inside; the maxillary palpi are 6-jointed, and the labial 4-jointed; the wings are veined, the anterior having several irregular cells, arranged somewhat like those of Oryssus and the Ichneumones adsciti, but the posterior are destitute of cells; the abdomen is attached to the dorsum of the metathorax by a peduncle, which sometimes arises close to the scutellum; the ovipositor is straight, and sometimes exserted; the hinder legs are the longest, with the tibiæ often incrassated. The species are parasitical.

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* BIBLIOGR. REFER. TO THE EVANIIDÆ.

C. G. Nees ab Esenbeck. Hymenopt. Ichneumon. affin. vol. ii. (Monogr. Evanial. Europ.)

G. Dahlbom. Excercitat. Hymenopt., Part 6. (Lond. Goth. 12mo. 1833. Monogr. Evan. Suec.)

Latreille, in Bull. Soc. Philomat. t. ii. (Pelecinus.)

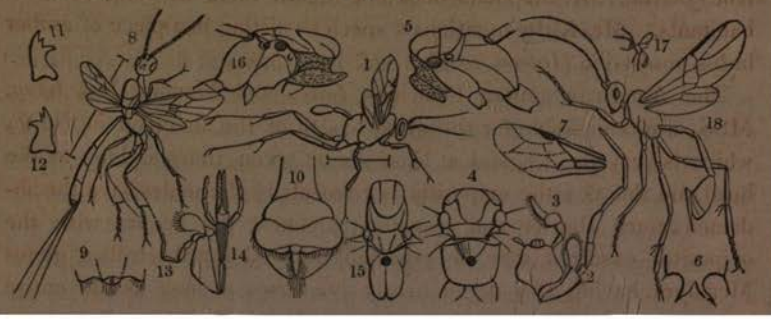
Serville, in Ann. Soc. Ent. France, tom. ii. 1833. (Aulacus patrati.)

Illiger, in Rossi Fauna Etrusca. 2d edit.

Westwood, in Griff. Animal Kingd. Insects. pl. 66. (Megalyra.)

Fabricius, Curtis, Jurine, Perty (Delect. An., art. Braz.).

Fig. 74.



Jurine, on account of the peculiar insertion of the abdomen, formed these insects into one of his three primary sections of the order.

The genus Evania *Fab.* (*fig.* 74. 1. Evania appendigaster, 2—6. details of ditto) is distinguished by the very short and much compressed abdomen, attached by its peduncle close to the scutellum. This peculiarity, although it appears, at first sight, anomalous, is dependent upon the excessive developement and thickness of the metathorax, of which the præscutum is reduced to a very slender dorsal piece, having the posterior wings attached at its sides, the metascutellum and metapostscutellum being confluent, although the limits of the metascutellum are indicated (of a triangular form and small size, terminating at the place of insertion of the abdomen) by an impression, the metapostscutellum being exceedingly developed (*fig.* 74. 4. Dorsal, and 5. Lateral, view of the thorax); the metasternum is also very remarkable, terminating in a strong furcate process of which the points are recurved and fitting into the posterior coxæ (*fig.* 74. 6.). The maxillary palpi are long and slender (*fig.* 74. 2. maxilla); but those of the labium larger, dilated, and irregular in their form (*fig.* 74. 3. labium); the trophi vary, however, considerably in the different species; the antennæ (which were described by Jurine as 13 or 14-jointed, according to the sex) are 13-jointed in both sexes, those of the females having the basal joint very much elongated. The veins of the wings vary in the different species, or rather those of the extremity of the wings are obsolete in the smaller species (Brachygaster *Leach*, *fig.* 74. 7.). The ovipositor is not exserted.

I have already recorded (vol. i. p. 422, 423.) all that has hitherto been observed relative to the habits of these singular insects. As

Evania appendigaster* and its immediate allies are parasites upon the true Blattæ, Mr. Stephens does not regard them as indigenous inhabitants. Mr. Kirby mentions a species existing in a piece of amber in his possession (*Introd. to Ent.* vol. iv. p. 558.).

The American genera Pelecinus *Latr.*, and Monomachus *Klug*, MSS., are remarkable for the great length of the abdomen in the ♀, which is very slender, and at least six or seven times as long as the head and thorax; the ovipositor is concealed; the males have the abdomen much shorter and clavate. Amongst the genera with the ovipositor exserted, may be especially noticed my Australian genus Megalyra, having this organ nearly five times as long as the entire body; and the indigenous genus Fœnus *Fab.* (*fig.* 74. 8. Fœnus jaculator, 9—16. details of ditto), which has the abdomen long and compressed, and gradually thickened to the extremity; it is inserted on the back of the metathorax (*fig.* 74. 15. dorsal, and 16. lateral view of the thorax); and when the insect is on the wing, it is elevated in the air at an angle with the rest of the body, giving, with the thickened posterior tibiæ, a most singular appearance to the insect. In respect to the structure of the thorax, this genus is even more remarkable than Evania, for here the mesothoracic scutellum is produced into a triangular piece, with two oblique impressions (forming the paraptera?), and extending to the place of insertion of the abdomen (*fig.* 74. 15. 16.), so that the præscutum and scutum of the metathorax are both apparently (dorsally) obsolete. The clypeus is triemarginate in front, the upper lip, which is membranous and internal, having its extremity alone exposed (*fig.* 74. 9.). The lip itself is very minute, and tongue-like, but the membranous parts to which it is attached are large (*fig.* 74. 10.). The mandibles in F. jaculator and F. australis *W.* are alike, with a very strong internal tooth (*fig.* 74. 11. 12.). Curtis describes them as unlike each other in F. assectator. The maxillæ are short, and terminated by a membranous lobe (*fig.* 74. 13.), and the labium or tongue is narrow, membranous, and elongate (*fig.* 74. 14.) The economy of F. jaculator *Linn.* was observed by Bergman, who communicated it to Linnæus. "Habitat in Apis truncorum, florisomnis Sphegisque figuli larvis; antennis perquirit ubi larva latet, avolat, redit et imponit ei ovum" (*Fn. Suec.* 1626); and hence Lehman

* Illiger cleared up the synonymy of these species in his edition of *Rossi Fauna Etrusca*. His names must, therefore, have the preference over those proposed by Curtis.

considered that the antennæ were necessarily employed as tactors, although they are so much shorter than the ovipositor. I have found this insect flying about walls in which Osmia bicornis breeds; but whether it is *in* the nest whilst in the progress of construction, or *upon* or *in* the body of the larva when hatched, that the egg is deposited, has not been decidedly observed. Latreille states that in the night, or during bad weather, they fix themselves by their jaws to the stalk of different plants, and are then almost in a perpendicular position.

The genus Paxylloma *Brebisson* (Plancus *Curtis*, Hybrizon *Fallen*, *fig.* 74. 17. P. buccata, natural size, and 18 ditto magnified), placed by Latreille and Haliday (*Ent. Mag.* vol. i. p. 343. and vol. iii. p. 22.) in this family, as well as Stephanus, appear rather to belong to the Ichneumones adsciti, or at least to constitute the links between them and the present family. The latter genus is placed by Latreille amongst the Ichneumones genuini; but the veins of the wings are arranged as in some of the Adsciti, especially Chænon. *Curt.*

I have illustrated the details of the various genera of which this anomalous family is composed, in a memoir presented to the Entomological Society, with descriptions of many species, not yet published.

The family ICHNEUMONIDÆ* *Leach*, corresponding with the greater part of the Linnæan genus Ichneumon, may, perhaps, be regarded as

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* BIBLIOGR. REFER. TO THE ICHNEUMONIDÆ.
(Ichneumones genuini.)

Gravenhorst. Nosographia Inchneumonum, 8vo. 1814. — Ditto, Monogr. Ichneum. pedestr. 8vo. Leipz. 1815. — Ditto (with C. G. Nees ab Esenbeck), Conspectus Gen. et Famil. Ichneum. in Nov. Act. Natur. Curios. t. ix. 1818. — Ditto, Monogr. Ichneum. Pedemont in Mem. Acad. Turin, 1820, t. xxiv. Ditto, Additamenta ad Descript. Fabric. Ichn. Mus. Hubneri, in Germar's Mag. der Ent. vol. iv. 1821. — Helwigia N. G. Ichneum. in Nov. Act. Acad. Nat. Curios. t. ii. 1823. — Ichneumonologia Europæa, 3 vols. 8vo. Vratislav, 1829. — Ditto, Ichn. Genuin. Sp. Cornutæ et Calcaratæ in Beytr. zur Ent. Schles. 1829. — Ditto, Moneta quædam. de Sp. Nigris Ichn. 4to. Breslaw, 1829.

Thunberg. Ichneumonidea, Pars i. et ii. Mem. Acad. St. Petersburg, t. viii. and ix. 1824.

one of the most extensive groups of insects *, distinguished (*fig.* 75. 1. Pimpla instigator: 2–13 details of this species) by having the abdomen attached to the thorax at its hinder extremity, and between the base of the posterior coxæ; the wings are veined, the anterior pair always exhibiting perfect cells upon their disc. The ovipositor of the

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Dalman. Pimpla Atrator in Kongl. Vet. Acad. Handl. 1825. — Ditto, Mem. on some Sp. of Ichn. 8vo. Stockh. 1826.

Trentepohl. Revis. Critica Gen. Ichn. Spec. quæ Kiliæ in Fabricii Mus. adhuc superstites sunt. 4to., Kiel, 1825; and in Isis, vol. xxii. 1826. — Ditto, Rev. Critica Gen. Cryptus Fab. Isis, 1829. — Ditto, Zehn arten G. Ichneum. in Lund's Samml. Isis, 1829.

Guérin. Pimpla Atrata Mag. Zool. Ins. No. 28.

Latreille, on Ichn. Pendulator in Bull. Soc. Philomat. t. ii. 1799.

Boudier. Observ. sur divers Parasites in Ann. Soc. Ent. de France, tom. iii.

Boerner. Ichn. Agricolator and murarius in Neue Nachr. der Schles. Patr. Gesell, 1781.

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Guérin. Voy. Coquille — Iconogr. R. An.

Haliday, in Linn. Trans. vol. xvii. — Ditto, in Annals Nat. Hist. vol. ii. Oct. 1838.

Stephens, Curtis, Spinola, Panzer, Fabricius, Jurine, Say.

(Ichneumones adsciti.)

Nees ab Esenbeck. Ichn. Adsciti in Genera et Famil. Divisi, &c. Gesellsch. Nat. Freunde zu Berlin Magazin, 1811, 1816 (and in Germar. Ent. Mag. vol. i.). — Ditto, Lapton femoralis in Gesell. Nat. Fr. Berl. Mag. 1815. — Ditto (with Gravenhorst) in Nov. Act. Nat. Curios. t. ix. 1818. — Ditto, Hymenopt. Ichneum. Affinium Monogr. vol. ii. 8vo. Stuttg. et Tubing. 1834.

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Wesmael. Monographie des Braconides de Belgique, 4to. Parts 1, 2, 3. 1835–8 (in Mém. Acad. Royale de Bruxelles, tom. xi. and separately).

Goeze, in Der Naturforscher, 12 Stuck. (2 Aphidii).

Olivier, in Mém. sur quelq. Ins. qui attaq. les Cereales, 1813. (2 Sp. of Ich. adsciti).

Boudier, in Ann. Soc. Ent. de France, tom. iii.

Dahlbom. Mon. Chelonus in Kongl. Vetensk. Acad. Handl. 1833.

Schiodte, in Kroyer's Naturhistorisk Tidsskrift, 1838. Heft. vi. (N. g. Copisura rimator).

Curtis, Spinola, Jurine, Panzer, Fabricius, Say.

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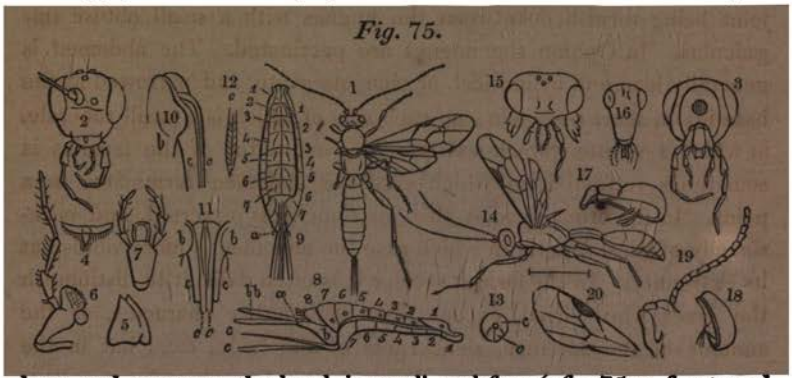
* Gravenhorst describes nearly 1650 species of European Ichneumones genuini, and Stephens and others have added greatly to their number.

females is straight, and often exserted; the antennæ are nearly always filiform or setaceous, not elbowed, and composed (except in a few of the minute Adsciti) of more than sixteen (sometimes reaching to sixty) joints, and the pupa is enclosed in a cocoon; the body is

Fig. 75.



long and narrow; the head is small and free (*fig.* 75. 2. front, and 75. 3. hind part of head); the eyes more or less prominent and lateral. The antennæ very seldom exceed the body in length; they are slender and filiform, except in a very few species, which have them more or less compressed, dilated in the middle or clavate; they are never elbowed, the basal joint being short, although thicker than the rest. In some species the males, and in others the females, are distinguished by having a broad annulus of white beyond the middle of the antennæ.* The parts of the mouth are small; the labrum (*fig.* 75. 4.) is very rarely entirely exserted, being ordinarily covered by the front margin of the clypeus; the mandibles (*fig.* 75. 5.) are generally slender and curved, narrowed to the tip, where they are bidentate; the maxillæ are terminated by two membranous lobes (*fig.* 75. 6.); the maxillary palpi are long and pendulous, and generally 5- or 6-jointed; the labium (*fig.* 75. 7.) is composed of a corneous elongated mentum of variable form, terminated by a generally quadrate membranous ligula, which is entire, or at least but slightly emarginate in some species; the labial palpi are 3- or 4-jointed. The thorax forms an oval mass; the collar is very short and annular; the mesothoracic scutellum is generally prominent, and often coloured different from the rest of the thorax; the wings are of moderate size;

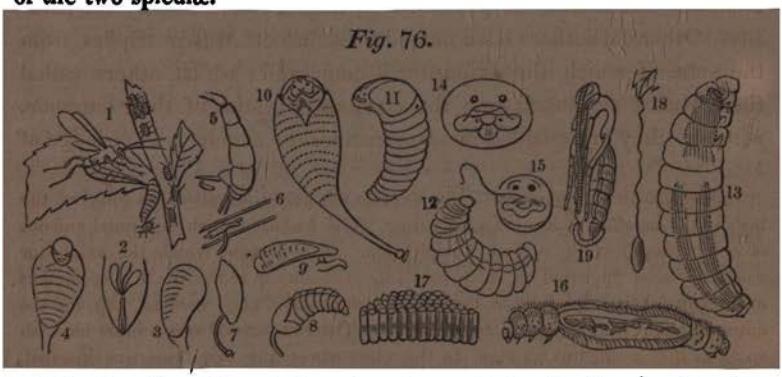
* G. H. K. Thwaites, Esq. has informed me that he has reared two females of Cryptus bellosus (*Curtis*, 668.), one of which had the antennæ annulated and the other entirely black.

the stigma is large, and the costal margin is thickened, or rather the costal and subcostal nerves are confluent, so as not to exhibit a subcostal cell. The legs are long, and formed for running; the trochanters are biarticulate; the tarsi long and slender, the terminal joint being furnished between the ungues with a small obtuse unguiculus. In Ophion the ungues are pectinated. The abdomen is generally long and cylindrical, or elongate ovate, and narrowed at the base into a short peduncle; on each side of which is a small tubercle, in which a minute spiracle exists. The ovipositor of the females is sometimes retracted, in which case the abdomen terminates in a point. In the other species this instrument is exserted, and occasionally of great length, in which case the abdomen is more obtuse at its extremity. In the former species it is often difficult to distinguish the sexes when dried, except from some other character, as the annulus of the antennæ, slenderness of the body, &c.; but in the latter, the males (*De Geer*, vol. ii. tab. 29. fig. 25. m.) as well as females (*Ibid.* fig. 23. m.) are furnished at the extremity of the terminal segment of the abdomen with the two inarticulated styles of which I have noticed the existence in the former families. Of the true construction of the ovipositor of the females I have hitherto met with no correct description. Réaumur (*Mémoires*, tom. vi. pl. 29.), De Geer (*Mémoires*, tom. ii. tab. 29.), Curtis (*Brit. Ent.* pl. 214.), Latreille (*Gen. Crust*, tom. iv. p. 2.), Gravenhorst (*Ichneumolog.* vol. i. p. 89.), and Burmeister (*Manual Transl.* p. 198.) have given figures and descriptions of this instrument and its details; but have failed in tracing its real structure. My figures 75. 8–13. will exhibit its structure as typically represented in one of the long-tailed species (Pimpla instigator), and which will be found to agree with that of Urocerus and Cynips. *Fig.* 75. 8. represents a lateral view of the abdomen of the female of the last-named insect, exhibiting the eight dorsal arcs (numbered 1 to 8), the seven basal ones being spiraculiferous, the eighth furnished at the tip with the two minute styles (*a*). On the under side of the abdomen there only exist seven ventral arcs (numbered 1 to 7), from the last of which arises on each side a corneous elongated plate (*b*), which is the basal portion of the outer sheaths * (*b*, *b*) of the ovipositor; the apical part of these

* Mr. Curtis, overlooking this basal portion, describes the sheath as arising from the superior angle, and as shorter than the ovipositor. Neither of which is correct, the basal portion of the sheaths and the eighth dorsal arc of the abdomen being inaccurately represented in his figure as confluent.

sheaths varies greatly in length in the different species; but the articulation always takes place near the extremity of the body: when at rest, these two demi sheaths (which are externally convex and pilose, but internally concave and polished) are brought into contact, and enclose between them the terebra or borer itself, which is a compound instrument formed (like the borer of Urocerus) of three parts, the superior (c) being nearly cylindrical, and channelled beneath for the reception of the two * slender, rigid, filamentous spiculæ (*c*, *c*), with membranous edges transversely striated at the extremity (*fig.* 75. 12.); the union of these three pieces forms a central passage (as in *fig.* 13. being a section of the borer itself, with the two spiculæ in situ) for the protrusion of the egg. *Fig.* 75. 9. represents the under side of the abdomen, with the different parts similarly lettered. *Fig.* 75. 10. exhibits a more highly magnified view of the base of the ovipositor, showing that (c) the superior channel of the terebra originates from the base of the basal part (b) of the outer sheath; and *fig.* 75. 11. represents the same parts beneath, c being the deflexed sides of the superior canal of the terebra, and *c*, *c*, the base of the two spiculæ.

Fig. 76.



* De Geer, Latreille, and Burmeister incorrectly describe the central terebra as composed of only two, instead of three, parts; the latter further endeavouring to refer this incorrectly regarded structure to that of Sirex (*loc. cit. supra*). Gravenhorst even regards the central terebra as not being a composite instrument. Réaumur has given numerous figures of the female of a species of Pimpla engaged in oviposition (in which the terebra is not represented as disengaged from its sheaths), and of the details of the ovipositor, but in a very rude manner. His fig. 10. pl. 29. tom. vi. represents the two rows of serrations at the extremity of the terebra "entre lesquelles une membrane blanche est sensible," besides which there is an elongated slender "corps blanc, que j'ai fait sortir du bout de la tarrière par la pression." This latter must, I should presume, be membrane rather than a distinct organ.

My figure 76. 1. will show the mode in which the abdomen of those species with short ovipositors is bent beneath the body, in the act of oviposition. This figure represents an Ichneumon (sp. ?) depositing its egg in the body of a young Syrphus larva, which is engaged in sucking an Aphis.* In those species which have a long ovipositor, it is ordinarily porrected in a straight line during rest; but in those with a short ovipositor, it is generally carried in a more or less oblique direction, pointing upwards; but when the insect is disturbed, or in the act of oviposition, it is disengaged from the sheaths, and is directed upwards and downwards (Gravenhorst doubts its lateral motion) at every angle from the line of the body.

The species are of small, or but moderate size; their colours are generally black, varied with red, yellow, or white; and the antennæ are often marked with a broad annulus of pale colour.

The name of Ichneumon has been given to these insects (which are parasitic upon other insects), from the similarity of their habits to that which has been fabulously attributed to the quadruped of that name, namely, that of depositing its progeny in the body of the crocodile, the entrails of which are by degrees devoured by the parasite. Other old authors have named these insects Muscæ tripiles, from the setæ of which the ovipositor is composed; whilst others called them Muscæ vibrantes, from the constant vibration of their antennæ, whereby they are enabled in some manner to acquire a knowledge of

* May 29. 1830, I observed a Pimpla with the ovipositor about as long as the body in the act of oviposition in a dry paling, which had been much perforated, and out of which I had just dug a black Pemphredon. The part in which the ovipositor was introduced appeared to be quite solid. (Réaumur represents his specimens as inserting their ovipositors in a circular patch of dried clay, used to stop up the entrance to the nest of the intended victim.) There are several very minute blackish spots, as they seemed to be, close to the place where the ovipositor was inserted, and which were probably other places of insertion of the ovipositor. When first observed, the insect had introduced about half the terebra into the post, the part remaining uninserted being at a right angle with the body, the sheaths being curved, their tips being brought to the place of insertion, thus evidently strengthening the terebra in its operations; the abdomen was at this time alternately turned from left to right, and vice versa, whereby a brad-awl kind of motion was given to the terebra, enabling it to penetrate the wood to a greater depth. It then alternately partially withdrew, and replunged the terebra into the hole thus made, as though in the act of passing an egg or eggs, standing all this while on the tips of the tarsi. On cutting, however, into the post, I was not able to discover any lignivorous larva, finding only a channel of fine white pulverised wood, which had been made by a previous occupier of the tube.

their food, and of the objects fitted for the reception of their eggs. Some species (Ophion) are, however, less agile, not vibrating their antennæ.

These insects are of vast importance in the economy of nature, by preventing the too great increase of different species of insects, especially of the caterpillars of butterflies and moths, of which they destroy a great number, it having been observed that a superabundance of any species of insect is attended with an increased production of its parasitic enemies.*

The females exhibit a wonderful instinct†, in discovering the proper receptacles for their eggs, consisting of the eggs, larvæ, or pupæ of other insects, as well as spiders. Those species which have the ovipositor short, attack exposed naked larvæ and pupæ; whilst those in which this organ is long, deposit their eggs in or upon the bodies of larvæ residing in the wood, or under the bark, of trees, or in deep crevices of the bark. In such cases, as I have often observed, the ovipositor is inserted in a perpendicular direction, the two external pieces, or sheaths, being entirely disengaged, and often raised into the air. (See also *Réaumur*, vol. vi.; and Marsham's account of Ichneumon manifestator in *Linn. Trans.* vol. iii. p. 26.)

Dalman, in his interesting memoir on this family, has made some curious observations as to the comparative numbers of these parasites and the other insects. (*Swed. Trans.* 1825; and in *Bull. Sci. Nat. Ferussac*, Jan. 1828.)

There is scarcely a tribe of insects which is not subject to the attacks of these parasites, although it is chiefly amongst the Lepidoptera that their ravages are confined. Amongst the Coleoptera, Timarcha tenebricosa and a species of Coccinella and Curculio have been recorded by De Geer and Kirby. M. Audouin has obtained Microctonus terminalis *Wesml*, from the perfect Coccinella 7-punctata, the larva of the former bursting forth and spinning its cocoon beneath the body of the

* Mr. Dale (*Mag. Nat. Hist.* No. 19.) gives an account of six specimens of Ophion vinulæ, and a specimen of Bombyx menthrasti, "hatched from the pupæ of Bombyx vinulus, which is certainly a curious fact."

† The female of the remarkable species Agriotypus armatus is stated to have been observed on the banks of the Clyde to descend the sides of the rocks to a considerable depth under the surface of the water, remaining immersed for ten minutes and upwards, and then reappear without any apparent injury, repeating the operation several times; these subaqueous wanderings being probably for the purpose of depositing its eggs in some aquatic larva. (*Ent. Mag.* vol. iii. p. 412.)

latter. M. Boudier describes two species of Braconides (S. G. Ganychorus *Hal.*) the larvæ of which burst forth from the abdomens of specimens of Barynotus elevatus, and Otiorynchus lignarius, in the imago state (which had been pierced with pins for preservation), and which spun their cocoons beneath the body of these weevils, attaching them to the pins. I have reared Perilitus similator from Orchesia micans. Bracon Cis *Bouché* attacks Cis boleti. A small, pretty, spotted-winged Cryptus enters our houses to prey upon the larvæ of the Ptinidæ, as do also Spathius clavatus and Hecabolus sulcatus; other species (Hemiteles areator, &c.) also frequent our dwellings, to deposit their eggs in the larvæ of Dermestidæ, Anthreni, Tineæ, and other domestic insects. Amongst the Hemiptera, the Aphides in particular are subject to the attacks of numerous species constituting a genus, thence named Aphidius.* The larvæ of a great number of Hymenoptera and Diptera are also subject to their attacks, and Mr. Kirby mentions an observation recording the occurrence of a minute species in Æshna viatica. Boudier has described a species of Cryptus which attacks the larvæ of Myrmeleon formicarium; and, which is very remarkable, not only are those species of insects which inhabit galls and cases liable to be infested by them, but even many of those parasitic larvæ which are themselves inclosed within the body of their victim; thus, two species of Hemiteles and one of Pezomachus are stated by Mr. Haliday to have been obtained from the cocoons of Microgaster intricatus (*Ent. Mag.* vol. ii. p. 468.). The larva of the Ophion moderator *Fab.* destroys that of Pimpla strobilellæ *Fab.* De Geer (*Mém.* vol. ii. p. 863.) has recorded a singular instance of an Ichneumon-larva infesting the outside of the body of a spider, which it ultimately destroyed; and numerous observations have been made, in which other species (Pimpla oculatoria, Hemiteles palpator, Ichneumon aranearum) deposit their eggs in the cocoon-like silken masses inclosing the eggs of some spiders, upon which the larvæ of the parasites feed and undergo their transformations within the cocoon; and Mr. Dilwynn says, "I have frequently observed a small black species successively deposit an egg in the abdomen of two or more spiders on the sand hills, and I doubt whether the spider had in any case arrived at its maturity. On one of those occasions, I perfectly recollect having seen a young brood of dark-coloured spiders on Crom-

* (See De Geer, tom. ii.; Harris *Aurelian*, *Der Naturforscher*, st. 12.) The habits of Aphidius Rosæ have been admirably described by Haliday in *Entomol. Mag.* vol. ii. p. 98., and by Kirby and Spence.

lyn burrows, and that when the Ichneumon hovered over them, they appeared alarmed, and instinctively endeavoured to escape (*Swansea Coleopt.* p. 27.; and see Boheman on Pimpla ovivora, in *Swed. Trans.* 1821, and *Bull. Sci. Nat.*; Davis in *Mag. Nat. Hist.* No. 19.; Bouché, *Naturgesch. Ins.* p. 145. With the exception of those species of Aphides which always remain in an apterous state, and which are subject to the attacks of the Aphidii, &c., no account has been published of the Ichneumonidæ attacking perfect insects, except the statement of M. Boudier, that he had observed a small Ichneumon "cramponné sur le dos de Trachyphlæus scabriculus. Il avait introduit sa tarrière entre les elytres et l'abdomen par l'anus" (*Ann. Soc. Ent. de France*, 1834, p. 322.), and a paragraph I have met with in an American Journal, in which it is asserted, that a female Ichneumon deposits its eggs in the body of the winged grasshopper, the interior of which is at length entirely consumed; "and, at the proper season, hundreds of grasshoppers in this condition may be found with just strength enough remaining to flutter to a tree or fence, and with a dying effort to fix their hooked feet so firmly as to retain their position long after death." I believe it has not been decidedly ascertained whether the species of these insects confine their attacks to precise species of caterpillars, &c., or whether the same species occasionally attacks others; the question has, however, repeatedly been proposed (Bree in *Mag. Nat. Hist.* No. 23.).* The majority of these insects deposit their eggs in the larvæ of other insects; but various instances are collected by Kirby and Spence, proving that they also attack the eggs, and more rarely the pupæ; thus Cryptus compunctor *Fab.* deposits its eggs in the pupæ of butterflies. In the *Insect Architecture*, p. 195., it is stated that an Ichneumon (Ophion luteum) had deposited its eggs in the cocoon of a puss moth; but this is, I apprehend, a misstatement, as that insect oviposits in the larva of the moth. Hitherto, no species of this family has been observed which is not parasitical. Mr. Curtis, indeed, published a species of Alysia (A. apii), of which the larvæ are stated to have been found feeding upon the parenchyma of celery leaves at the end of September (B. E. 141.); but he subsequently

* Greenhow (in *Mag. Nat. Hist.*) asserts that Microgaster glomeratus attacks both Pontia brassicæ, and Arctia cajæ; but he had not evidently investigated the species of the parasite. Bouché more minutely describes M. glomeratus as attacking several allied species of the white butterflies, describing other species as distinct which infest Pieris cratægi (M. pieridis), Arctia cajæ (M. cajæ), and Liparis dispar (M. liparidis). *Naturgesch. der Ins.* p. 151.

ascertained that this insect is parasitic upon a species of Tephritis, which is found in that situation. (*Ibid. Add.* vol. vii.). M. Audouin, however, has shown me the details of the history of a species which he had reared from a larva, which he was led to believe fed upon the pith of a reed in which it was found, since no traces of any insect upon which it could have subsisted were to be seen; but this observation does not appear to me sufficiently conclusive.

In *Corbyn's India Review* (Nov. 1836.), an account has been published by Mr. Baddeley, of one of the Adsciti which inhabits the galls on the leaves of Ficus racemosa in India, caused by a Cecidomyia, and in which it is asserted that the Ichneumon- and Cecidomyia-larvæ "live independently, and feed upon the vegetable juices without detriment to each other; although, at the first, the Ichneumon larva lives and grows for a certain time at the expense of the Cecidomyia larva. The former, however, subsequently acquires herbivorous habits, feeding in concert on the juice of the interior of the gall; in this occupation it continues to grow without detriment to the other inmate. The natural history of the two species appears to have been very carefully traced and figured, with numerous details, leading to the belief in the correctness of this statement.

The developement of these parasites* within the bodies of other insects was for a long time a source of much speculation amongst the earlier philosophers, who conceived it possible that one animal had occasionally the power of being absolutely transformed into another; thus, Swammerdam records, as a "thing very wonderful," that 545 flies of the same species were produced from four chrysalides of a butterfly, "so that the life and motion of these seems to have *transmigrated*, into those of the 545 others." (Hill's *Trans. of the Bibl. Natur.* p. 122.)

The eggs of the genus Ophion are of a singular form (*fig.* 76. 7.) being somewhat bean-shaped, and attached near one end to a long, slender, and curved peduncle, by which they are attached (unlike the majority of the eggs of this family, to the surface of the body of the larva of Cerura vinula, the puss moth); when the eggs are hatched, the larva retains itself in this situation, the extremity of its abdomen being retained within the shell of the egg (*fig.* 76. 8.), whereby they are enabled to suck the juices of their victim (De Geer, *Mémoires*, tom. ii. tab. 29.)† Gravenhorst first noticed (*Ichn. Eur.* ii. 151. and 222.),

* See observations under the section Fossores, as to the correct application of this term.

† Réaumur (*Mém.* vol. ii. pl. 34. f. 4, 5.) has represented a caterpillar, which

that the females of various species of the genus Tryphon (T. pinguis and varitarsus) were furnished near the extremity of the abdomen on the underside with a variable number of small pear-shaped or oviform vesicle-like bodies, of a white or straw colour, being more obtuse and darker-coloured at the tips, of which he says, "ova esse videntur." Subsequently Haliday communicated to Curtis specimens of the latter insect, "with a sketch of the larvæ, for such they are, and not eggs," in different stages; and he found as many as eighteen of them attached to one insect (*fig.* 76. 2.): "at first they are all smooth, pear-shaped, and of a shining opaque waxy tint (*fig.* 76. 3.), but in a few days they appear as represented at *fig.* 76. 4., which is the underside; at this stage its voracious powers develope themselves, and I find the oldest generally making a meal of his next neighbour." He observed two motions in the mouth, one an opening and shutting of the mandibles; the other, a general dilatation and contraction of the membrane of the mouth. The observations of De Geer enable us to judge of the true nature of these bodies respecting which Curtis (B. E., 399.) has made some remarks. It is evident that the insect, probably in the agony of death, had extruded its already developed and impregnated eggs, without being able to place them in their true locality, whence they remained attached to the abdomen of the parent, the larvæ shortly afterwards hatching (as in Ophion), and feeding, for want of its own food, upon its congeners. Dr. Hartig has still more recently published an interesting memoir on the pedunculated eggs of various Ichneumonidæ (*Archiv. für Naturg.* vol. iii. tab. 4.), exhibiting the abdomen of Tryphon cancer, with a very great number of eggs attached to its extremity beneath; Tryphon caudatus in the act of depositing a pedunculated egg (*fig.* 76. 5., 76. 6., showing the passage of the egg down the ovipositor); the singularly pedunculated egg of Sphinctus serotinus and Paniscus testaceus (*fig.* 76. 9.), together with the egg hatched, with the head of the larva exposed (*fig.* 76. 10.), and with the larva itself detached from the eggshell (*fig.* 76. 11.).

feeds on the stems and head of a species of thistle, to the exterior surface of the body of which a small parasitic larva is attached, being evidently a small Ichneumonideous larva, the head of which is described as having "deux espèces de cornes," and as being destitute of hooks or teeth. De Geer has described an Ichneumon larva, found on the outside of the body of a spider, which it destroyed, and has figured a larva of Cerura vinula, on the surface of whose body are numerous minute naked larvæ, apparently of a species of Microgaster, some of which have spun cocoons. (*Mém.* vol. i. pl. 23. f. 17.)

The larvæ of these insects (*fig.* 76. 12.) are destitute of feet, having a soft, white, fleshy, and nearly cylindrical body, with lateral fleshy tubercles, generally slightly curved and narrowed at each extremity; the first segment, or the head (*fig.* 76. 14.), furnished with two distinct round points in those larvæ which I have examined, resembling ocelli, beneath which is a transverse fleshy upper lip, and two obliquely deflexed horny mandibles, very small, slender, and acute: beneath these is a curved fleshy lobe of three parts, formed by the union of the dilated maxillæ and labium. Réaumur has rudely represented these parts (*Mém.* tom. ii. pl. 33. f. 4.); but he describes the head as being concealed by a sort of "chaperon charnu" (fig. 3. cc.) which I have not recognised in my various larvæ of this family. The figure given by Lyonnet of the head (*fig.* 76. 15.) of the larva of Ophion luteum agrees with my observations (*Posth. Mém.* pl. 24. fig. 7.)* Those larvæ which reside, like the intestinal worms, *within* the bodies of caterpillars (sometimes in society), as the Microgasters, which infest the caterpillars of the white butterflies (*fig.* 76. 16.), carefully avoid touching the vital organs of their victims, feeding only upon the fatty matter: when, however, they have attained their full size, and are ready to assume the pupa state†, they pierce the skin of the larva, which soon dies, spin for themselves cocoons beneath its body (or within the cocoon which it had formed for its own grave), and undergo their transformations. Such are the habits of the minute species of Microgaster which attack the common cabbage-butterfly, and which deposit a great number of eggs in the same caterpillar, so that the parasitic larvæ, when hatched, live in society (Réaumur, *Mém.* tom. ii. pl. 34.)‡; whereas many species deposit only one, or but very few eggs, in the body of a caterpillar. The larvæ of other species do not destroy their victim in its larva state, but allow it to become a pupa, in the body of which they undergo their transformations, not making their

* De Geer's figures of the head of the larva exhibit the acute mandibles, but the fleshy lips are of different forms to those described above. (*Mém.* vol. i. pl. 34. f. 11. and 12.

† M. Audouin has described a small species (Ophion Dositheæ), the larva of which continues to feed upon the caterpillar of the Dosithea after it has burst forth; and which partially employs the skin of the caterpillar in constructing its own cocoon. (*Ann. Soc. de France*, 1834, p. 417.)

‡ The Rev. W. Bree and Mr. Newman have published some observations on this genus (*Mag. Nat. Hist.* No. 23., and Westwood in Ditto, No. 25.); Mr. Newman noticing a filiform appendage attached to the tail of the larva of the Microgaster, which he suggests may serve as an umbilical cord for taking food.

appearance until after they have become perfect insects. Ratzeburg, in *Nova Acta* (vol. xvi. pl. 9.), has figured the larva and pupa of Hemiteles luteator, with the view of showing that the head of the pupa is formed from the two first segments of the larva, representing the eye of the pupa as visible through the skin of the second segment of the larva. In my unpublished memoir upon Trichiosoma lucorum and its parasites, observed ten years ago, I had not only noticed this circumstance, but had observed that the fifth and following segment of the larva, immediately before assuming the pupa state, is contracted; but on carefully examining the insect in this state, it is evident that it is owing to the increased development of the head of the inclosed pupa, that an alteration has taken place in the relative position of the anterior segments, which cannot be considered as a proof that the head of the pupa had occupied two segments instead of one. My figure 76. 13. represents another larva (preserved in spirits), ready to undergo its transformation to the pupa, showing the head of the latter disengaged within the skin of the larva, and occupying the second segment of the body, the antennæ extending into the first segment.

The larvæ of the majority of these insects spin a silken cocoon, in which they pass the pupa state; these cocoons are sometimes found in a mass together, and are often enveloped in a general covering of yellow or white glossy silk (which has been incorrectly stated by some authors to be spun by the dying caterpillar for the covering of its parasites, although it ordinarily spins but a few threads for supporting itself by a girdle round the body), forming a large oval mass, whichmay often be observed upon railings, walls, stems of plants, &c. Such are the habits of Microgaster glomeratus *Rösel*, and some allied species (Réaumur, *Mém.* tom. ii. tab. 33. and 35. fig. 1, 2. 6.; and T. H. [Gen. Hardwicke], in *Mag. Nat. Hist.* No. 11. incorrectly named Ichn. ovulorum). In one species the cocoons are arranged in a symmetrical manner, like the cells in a miniature bee-hive, without any external covering (Réaumur, *Mém.* tom. ii. pl. 35. f. 7, 8., representing the cocoons of Microgaster alvearius). My figure 76. 17. represents a mass of fifty-two of these cocoons arranged symmetrically, discovered by Mr. Ingpen, which appeared to have been attached on one side to a sprig, and from which the insects had escaped both at the top and bottom, by cutting open the circular lid of each cocoon. In a species of Cryptus, of which I have observed the transformations, the cocoon is long, cylindric, and rounded at each end; and I distinctly noticed that it was composed of three separate layers, the two interior being very shining, and of a gummy

membranous texture, and each of them formed of a distinct elongated cap at each end of the cocoon. This formation was found to exist in several of the cocoons. Some cocoons are entirely white or yellow, and composed of glossy silk which can be wound off; but others are variegated and banded with black, of which Réaumur has figured various species (*Mém.* tom. ii. pl. 35. and 37.), minutely describing the process of formation. Other cocoons are suspended by a fine thread to leaves or twigs, sometimes three or four inches long*; and Réaumur, who described two kinds, has observed that one of them is evidently the parasite of the processionary caterpillars, as he found them by dozens in the neighbourhood of the nests of those caterpillars; and that the other cocoon, when detached from the twig, sprang to a distance of several inches, the inclosed larvæ probably contracting its body, or perhaps bringing the two extremities of the body together, and then suddenly letting them go, in a manner similar to the motions of the common cheese-hopper. De Geer obtained larvæ of a species of Perilitus (Zele *Curtis*), which formed suspended cocoons from the caterpillar of Zygæna filipedulæ (*Mém.* tom. ii. tab. 44. f. 11. 13.); and Curtis reared a species of Perilitus (P. pendulator *Latr.*, Ephippium *Curt.*) from a cocoon suspended from the nut (*fig.* 76. 18.); and see Latreille's Memoir on Ichneumon pendulator, the last-named species in *Bull. Soc. Philomat.* 1799, tom. ii. p. 138. Some few species, however, especially amongst the Adsciti do not construct cocoons when their peculiar habits render this unnecessary. Such, for instance, is the case with the Aphidii, which undergo their transformations within the indurated skin of the Aphis, of which they have devoured the interior. The spherical shape of the case thus formed accords with the curved attitude of the full-grown larva, and of the pupa developed from it (Haliday, *Ent. Mag.* vol. ii. p. 225.). In the majority of the true Ichneumonidæ, Braconidæ *Stephens*, and others,—the pupa is not bent double, and the cocoon is more elongated. Ratzeburg figures the pupa of Hemiteles luteator as bent double; and this is probably the case with all those species which oviposit by extending the tip of the body beneath the fore-legs. In the *Mag. Nat. Hist.* (vol. viii. p. 171.) I have described one of the Adsciti (Chænon nigricans) produced from pupæ found in the sheathing leaf of the flowering stalk of the common barley. The pupa (*fig.* 76. 19.

* Réaumur has made no observation as to the mode of construction of this curious cocoon. It seems, however, most probable that the larva having first suspended itself by a thread, commences the formation of its cocoon whilst remaining suspended.

pupa of Pimpla instigator) bears a great resemblance to the imago, except in having the limbs laid along the breast. In those species with an elongated ovipositor, it is curved backwards, and laid along the back, sometimes extending to the head (De Geer, *Mém.* tom. ii. tab. 29. f. 6, 7.). M. Boudoir has made some curious observations of the different situation of the male and female pupæ of a species of Cryptus within the cocoon of Bombyx quercûs (*Ann. Soc. Ent. de France*, 1836, p. 358.) In the genus Chelonus, the female, according to Dufour (as cited by Haliday, *Ent. Mag.* vol. v. p. 213.), produces her young, not in the state of eggs, but of adult pupæ. The larva of Chelonus (Rhitigaster) irrorator, however, according to De Geer, is parasitic upon that of Noctua Psi. (Wesmael says "noctuelle pyramidale" incorrectly.)

The perfect insects are found flying amongst trees and plants, and especially frequenting the heads of umbelliferous flowers, whence they derive a great portion of their nourishment, which consists merely of the nectar of those flowers * (Fabricius, *Gen. Ins.* p. 114.; Gravenhorst, *Ichn. Europ.* vol. i. p. 95.). I have observed that they are very fond of licking the leaves of plants besmeared with honey dew. Some species whose females are furnished with a very long ovipositor, are found on the trunks of trees, stumps of wood, &c., evidently searching for the lignivorous larvæ, in which they deposit their eggs; whereas those which have short ovipositors seek external-feeding larvæ for the reception of their eggs. From the circumstance that these insects in the perfect state are not ordinarily observed preying upon other insects, it may be inferred that the accounts recorded in the old authors of their voracious propensities, applied to some species of Sphegidæ rather than of Ichneumonidæ. When taken in the fingers, they immediately disengage their terebra from its sheath, and attempt to sting, causing a painful irritation for the moment, if they puncture a tender part, but which so quickly passes away, that it is evident no very powerful poison can be introduced into the wound.

They fly with considerable agility; and I have noticed that some of the smaller species during flight deflex the extremity of their antennæ. Some of these insects when handled emit a powerful, and by no means pleasant scent. M. Wesmael has described a remarkable Gynandromorphous specimen, having the head and thorax, with the

* E. W. Lewis observed Pimpla stercorator devour a leaf-rolling caterpillar of the lilac, which it had the instinct to dislodge by pricking the roll of the leaf with its ovipositor. (*Mag. Nat. Hist.* vol. vi. p. 414.)

organs attached thereto, of the female sex (Ichn. extensorius), while the abdomen and its appendages are masculine (I. luctatorius), in the *Bull. Acad. Sci.* Bruxelles, vol. iii. 1836. Réaumur (*Mémoires*, tom. vi. mém. 9., tom ii. mém. 11., &c.), De Geer (*Mémoires*, tom. i. passim, and tom. ii. pl. 29, 30.), Kirby and Spence (*Introd.* vol. iv. chap. 44.), Bouché (*Naturgeschichte des Insect.*), Lozier (in *Trans. Amer. Phil. Soc.* vol. v. 1802), Rösel (*Ins. Bel.* vol. ii. Bomb. Vesp. tab. 4—6.), Disderi (in *Transact. Turin Acad.* vol. ii.), Goeze (in *Der Naturforscher*, vol. v.), Frisch and Gödart (in various of their plates), and Drewsen and Boie (in *Wiegmann's Archiv. für Naturg.* vol. ii. No. 1. translated in *The Naturalist*, 1837), have given many details relative to the natural history of different species of this family.

In the last Linnæan edition of the *Systema Naturæ* seventy-seven species were described as appertaining to the genus Ichneumon, divided into seven sections, of which all except the last were founded upon the colour of the scutellum and antennæ, the last being thus described, "Minuti, antennis filiformibus, abdomine ovato sessile" (vol. ii. p. 938.). The species introduced into this section (except I. Aphidum, globatus, and glomeratus) belong to the families Chalcididæ and Proctotrupidæ. Fabricius, Jurine, and Latreille (in his earlier works) proposed the separation of various genera from the mass of true Linnæan Ichneumons, which by degrees became restricted to the group as above characterised; the families Evaniidæ, Chalcididæ, and Proctotrupidæ having been established upon species most of which had at first been regarded as Ichneumons. In the joint memoir of Gravenhorst and Nees ab Esenbeck, published in 1818, the Ichneumonideous genera were first divided into two stirpes — the Ichneumones genuini and the Ichneumones Adsciti; these two stirpes being further divided into numerous genera; the Adsciti being primarily divided into two groups named Bracones and Bassi (the latter name being very inappropriate, the genus Bassus belonging not to this group but to the genuine Ichneumons, and which Stephens accordingly changed to Alysiidæ).* Fallen subsequently (1823) divided the family into two groups, corresponding with the Genuini and Adsciti of Gravenhorst and Esenbeck, but characterised, — 1. "alis area speculari instructis," and 2. "alis area speculari destitutis." Latreille, in his later works, and Stephens (*Catal.*) formed the Ichneumons into three primary divisions, answering to the Genuini,

* Nees ab Esenbeck, in his *Monographiæ* (1834), retained these two groups, terming them Ichneumonides Braconoidei, and Alysioidei.

Bracones, and Bassi of Gravenhorst and Esenbeck, and founded principally on the variations in the number of joints of the palpi, a character which has since been proved to be of too slight a value amongst the Adsciti. Mr. Haliday, in his systematic distribution of the Adsciti (*Entom. Mag.* vol. i. p. 261. 1833.), divided them primarily thus: —

* Abdomen sub pectus incurvatile.	G. Aphidius.
** Abdomen haud penitus incurvatile.	
1. Areola antica disci contigua completa.	G. Sigalphus, &c.
2. Areola antica disci remota vel incompleta.	G. Microgaster, Bracon, Alysia, Agathis, Leiophron, &c.

Mr. Stephens (*Illustr. Brit. Ent.* vol. vii. p. 117. 1835.), retaining the number of joints in the maxillary palpi as the leading character, has separated the Ichneumonidæ into four families: 1. Ichneumonidæ, 2. Braconidæ (max. palpi 5-jointed); 3. Alysiidæ (m. p. 6-jointed); and 4. Aphidiidæ (m. p. 4-jointed). Still more recently, Mr. Haliday (*Ent. Mag.* No. 23. 1838) has divided them into five families, including, 1. Evaniidæ; 2. Ichneumonidæ; 3. Agriotypidæ; 4. Braconidæ; and 5. Aphidiidæ, founded upon the nature of the connexion between the 2 and 3 dorsal segments of the abdomen, and the outer discoidal cell of the fore-wings. On reviewing these arrangements, it appears to me that it will be far more natural to retain the binary division of Ichneumones genuini and adsciti; and such is the opinion also of my friend M. Wesmael, who characterises the former (Ichneumonides) by having two recurrent nerves, and the latter, which he names Braconides, by having only one recurrent nerve.

The sub-family Ichneumonides comprises the largest species of the family; and is not only distinguished by having two recurrent nerves, but also by having the nerve which separates the first cubital or submarginal cell from the external discoidal cell, either entirely or nearly obliterated, whereby these two cells become confluent. No genuine Ichneumon with perfect wings has yet been described in which this structure does not exist. Moreover, the second cubital or sub-marginal cell (the area specularis of Fallen) is very greatly reduced in size, being sometimes petiolated, but often entirely obsolete. It is in this minute area, or in the space which it should typically occupy, that the second recurrent nerve is inserted: M. Wesmael also adds the existence of an articulation between the second and third dorsal segments of the abdomen.

Amongst the Ichneumonides may be noticed the genera Pimpla, in which the ovipositor and its sheaths are often greatly elongated, being

in some exotic species three or four inches in length; Ophion *Fab.*, having the abdomen greatly compressed and sabre-shaped; Euceros* *Grav.* and Joppa *Fabr.*, having the antennæ dilated in the middle; of the former genus males only have been observed; and Hellwigia, (for which I am indebted to Dr. F. Klug) having the antennæ strongly clavate at the extremity in both sexes. The interesting genus Agriotypus *Walk.* (*fig.* 75. 14. A. armatus ♂, for which I am indebted to F. Walker, Esq.) is remarkable for its long curved petiole to the abdomen, spotted wings, and spined scutellum; the radial cell is short, whence, as well as in the form of the abdomen, it appeared to Latreille to form the connecting link between the Ichneumonidæ and Proctotrupidæ. Its palpi and the cubital cell of the fore-wings, however, evidently prove its affinity with the true Ichneumonidæ; although Mr. Haliday, on account of the want of articulation between the second and third dorsal segments of the abdomen, has formed it into a distinct family: but this latter character is proved by such genera as Chelonus, Sigalphus, &c., to be but of secondary importance amongst the Ichneumonidæ.

The sub-family Braconides (Ichneumonides Adsciti *Esenb.*), on the other hand, is characterised by having only one recurrent nerve, which unites with the nerve, (almost always present) extending between the first cubital and externo-discoidal cells; the second sub-marginal cell being often as large as the preceding, and not receiving a recurrent nerve, and the non-existence of articulation between the second and third dorsal segments of the abdomen. In Agathis and some Microdi and Microctoni the nerve between the first cubital and externo-discoidal cell is obliterated, as in the genuine Ichneumons.

M. Wesmael divides the Braconides as follows: —

A. Endodontes. Having the teeth of the mandibles directed inwardly. The mandibles meeting together when shut. Divisible into

1. *Polymorphi.* Clypeus entire, abdomen 6- to 7-jointed, posterior part of the vertex convex, second submarginal cell (when present) large.
2. *Cryptogastri.* Clypeus entire, posterior part of vertex convex, abdomen dorsally presenting not more than two transverse sections, second submarginal cell (when present) large.

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* From the similarity of this name to Eucera, another Hymenopterous genus, I have proposed to alter it to Eumesius. The species of this genus are extremely rare, and I am, therefore, happy in being able to state the history of Mr. Curtis's specimen of E. crassicornis, which was reared by the late Mr. Blunt from Achatea piniperda, as that gentleman informed me some time before his decease.

3. *Areolarii*. Clypeus entire, vertex more or less emarginate behind, abdomen 6- to 7-jointed, second submarginal cell (when present) very small.
4. *Cyclostomi*. Clypeus deeply notched, leaving a circular aperture between it and the jaws, abdomen generally 6- to 7-jointed, second submarginal cell (when present) large.

B. EXODONTES. Having the teeth of the mandibles directed outwards, the mandibles, when closed, not touching each other.

Mr. Haliday, who has been so kind as to furnish me with the generic synopsis of the Ichneumones Adsciti, added as a distinct sub-family the Aphidii and allied genera, which have the articulation between the second and third abdominal segments flexible. I, however, regard them as a group equivalent with Wesmael's other sections, and which it might perhaps be more natural to arrange either before or after the Polymorphi, with which they are united by Wesmael. This might be done by inverting the arrangement of these sections, so that the Aphidii, which are the least perfectly organised of all the Ichneumonidæ, might be retained at the end of the family.

"The habits of the Ichn. Adsciti or Braconides," as well observed by Haliday (*Ent. Mag.* vol. i. p. 482.), "so far as ascertained, presenting no broad distinction from the rest of the family," I have thought it most advisable to treat of the economy of the entire family at once, without introducing that of each under the descriptions of the two sub-families which would have required much repetition. Many of the genera exhibit various interesting peculiarities of structure, as, for instance, the partial or complete coalition of the dorsal segments of the abdomen in Chelonus (*fig.* 75. 18.), Sigalphus, Rhitigaster, &c. (*fig.* 75. 17.); the gaping mandibles of Alysia (*fig.* 75. 15.); the rostrated front of Agathis (*fig.* 75. 16.); the anomalous antennæ of Streblocera *Westw.* (*fig.* 75. 19., 75. 20. wing of ditto); the paucity of joints of the antennæ in some of the Aphidii and other aberrant genera; the very elongated ovipositor and variegated wings of many Bracones; and the existence of a stigma on the front margin of the posterior wings of the males in Heterospilus and Hecabolus.

The family CHALCIDIDÆ* *Westw.* (Cynipsera *Latr. Genera*, Pteromalini *Dalm.*, Diploleparіæ *Spinola*), is composed of a very great

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* BIBLIOGR. REFER. TO THE CHALCIDIDÆ.

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Kirby (n. sp. Eulophus), in Linn. Trans. vol. 14. — Ditto, in ditto, vols. iii. iv. v. (Various species.)

Fig. 77.

number of parasitic species distinguished by their generally very minute size (*fig.* 77. 1. Chalcis nigrifex *Sulzer*, C. sispes *Fab.* nec

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Boyer. Obs. sur un Ver, qui se trouve dans l'intérieur des Pepins de la Pomme, Bull. Soc. Philomat. t. iii.

Spinola, in Annal. du Mus. d'Hist. Nat. tom. xvii. 1811. (Essai Nouv. Classification des Diplolepaires.) — Ditto, in Insecta Liguriæ. — Ditto, in Guérin, Mag. Zool. 1837. (Conura.)

Dalman, Forsok till Uppstalling, &c. (Classif. of Pteromalini of Sweden, in Kongl. Vetensk. Acad. nya Handling. — 1820-1822, and separate, Stockholm, 1820.— Ditto, in ditto, 1815. various detached species. — Ditto, in Analecta Entomologica. (Agaon.)

Bohemann, in Kongl. Vet. Acad. Handl. 1833. 1835.

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Tourette, in Mém. Sav. Etrang. à l'Acad. des Sciences, t. ix. (Leucospis.)

Klug, in Der Gesellsch. Naturf. fr. zu Berlin Mag. vol. vi. (Leucospis.) — Ditto, in Ehrenberg Symbolæ Physicæ, Decas 4. 1834. (Leucospis, Chalcis, and Dirhinus).

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Treviranus. Sur l'Insecte qui habite les Figues, in Linnæa, tom. iii. 1828.

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Linn., C. petiolatus *Curt.*), brilliant metallic or variegated colours, elbowed antennæ, short palpi, nearly veinless wings, and naked pupæ.

The head is transverse; the face large, and often longitudinally notched for the reception of the basal joint of the antennæ; the eyes lateral, and in a few species of a very large size (Macroglenes inserens (*fig.* 77. 2—7. under side of the head, and details of Leucospis gigas): the antennæ are short, often thickened towards the tips, and composed of a small number of joints, varying from six to thirteen; the basal joint is long and erect, the antennæ being elbowed and deflexed at its extremity; the three terminal joints in both sexes are often compactly soldered together: these organs often vary very considerably in the sexes (*fig.* 77. 8. ant. of Cheiropachus ♀, 77. 9. antenna of Trichogramma evanescens, *Westw.*). The labrum is minute (*fig.* 77. 3.), and often concealed; the mandibles are broad, horny, and generally terminated by several teeth (*fig.* 77. 4.); the maxillæ are elongated with a large suboval membranous terminal lobe (*fig.* 77. 5. and 77. 10.); the maxillary palpi are very short, and more or less filiform, never composed of more than 4 joints, of which the basal joint is often very minute, and the terminal joint the longest, thickest, and clothed with longer rigid setæ. The mentum is long and narrow, the labium terminated by a large rounded membranous lobe, and the labial palpi short, and 2- or 3-jointed (*fig.* 77. 6. labium of Leucospis, 77. 10. maxillæ and labium of Pachylarthrus ♂). The Thorax forms an oval or elongate-oval mass; the collar is generally distinct, and either triangular or transverse-quadrate; the mesothoracic scutum is large, often with a distinct oblique impression on each side separating the *parapsides* *; the mesothoracic scutellum is generally very large and rounded, the metathoracic præscutum and scutellum being also distinct (*fig.* 77. 17. thorax of Cleonymus depressus above). The anterior wings are almost veinless, although in certain positions the situation

in Griff. An. Kingd. Ins. pl. 77. — Ditto, in Royle's Himalaya. (Dirhinus n. sp.)

Haliday, in Entomological Magazine, vol. i.

Bouché. Naturgesch. der Insecten.

Christius, Fabricius, Curtis, Panzer, Zetterstedt (Ins. Lapp.), *Say* (Journ. Boston N. H. Soc. vol. i.), *Perty.*

* Mr. MacLeay alludes to this peculiarity in Chalcis, and considers that the scutum of the mesothorax is thus proved to be typically composed of three pieces when at its maximum of development. (*Zool. Journ.* No. 18. p. 158. n.)

of the obsolete veins is indicated by lines indistinctly marked; ordinarily a strong subcostal vein running parallel with the anterior margin extends about half the length of the wing, where it unites with the costa, along which it is continued for a short distance, and then sends forth a short vein, generally thickened at the tip, and which descends into the disc of the wing in an oblique direction. In some species this descending vein is very short and thick, as in Magastigmus; in others it is emitted close to the union of the subcostal vein with the costa; and in the Aphelini, &c., it is wanting. The lower wings have only a short subcostal vein. The abdomen is of varied shape both in the different species and in the sexes of the same species: it is ordinarily 7-jointed in the males, and 6-jointed in the females, the basal joints being the largest, sometimes attached by means of a long narrow peduncle (as in *fig.* 77. 1.); whilst in other species it appears quite sessile, although in reality connected with the thorax by a very short narrowed portion of its base. The ovipositor is generally concealed, and not longer than the abdomen. In others (especially in Callimome, &c.) it is very long and exserted. It is straight, and originates at a considerable distance from the apex of the abdomen on the under side (*fig.* 77. 15. abdomen of Eulophus Nemati ♀); its composition is precisely similar to that of the Ichneumonidæ, consisting of two lateral valves (*fig.* 77. 15. *b*, and *b b* being the articulated extremity, which in Callimome ♀ (*fig.* 77. 20.) is greatly elongated, forming the sheathes of the ovipositor), inclosing a nearly cylindrical borer, channelled on the under side (*fig.* 77. 16. c), and furnished with two delicate spiculæ (*fig.* 77. 16. *c c*). *Fig.* 77. 14. represents the extremity of the abdomen of Cheiropachus quadrum *Westw.* ♂. The fore-legs are generally simple, but the posterior pair are sometimes varied in their form; in many they are also simple; but in others (Chalcis, &c. *fig.* 77. 1.) the femora are incrassated, and toothed beneath, and the tibiæ have a corresponding curve. In some genera (Eupelmus, Encyrtus, &c.) the intermediate legs are singularly formed, the tibiæ being thickened and furnished with a broad and long spur internally serrated, the tarsi being broad (*fig.* 77. 12. Ectroma *W.*), the mesosternum being also considerably developed. The tarsi are 5-jointed (*fig.* 77. 11. fore-leg of Cheiropachus quadrum ♀), except in Eulophus and the allied genera, in which they have only 4 joints (*fig.* 77. 13. fore tarsus of Eulophus Nemati *W.*), and are terminated by a large pulvillus. The incrassation of the hind

legs does not (as in the Halticæ, &c.) indicate saltatorial powers; Chalcis, &c., not being able to leap, whilst many of the small species with simple legs leap well; but it is amongst those which have the large intermediate tibial spur that we meet with these powers best developed, the Encyrti, &c., being able to leap to an extraordinary distance.

The sexes of many of these insects are distinguished by various singular modifications of structure, independent of the more slender form of the body, and of the antennæ of the males: thus in the males of many Eurytomæ, &c., the joints of the antennæ are nodose, and furnished above with long hairs: the females of Cratomus have the heads of a very large size, being much broader than the thorax; Cheiropachus *Westw.* has the posterior femora of the males, and the anterior of the females (*fig.* 77. 11.) thickened; Cerocephala *Westw.* has the head of the male curiously tricornuted. In Mesopolobus *Westw.* the maxillary palpi of the males are furcate, the third joint being externally prolonged; and the middle tibiæ have a small triangular lobe on the outside; in Platymesopus *Westw.* the middle tibiæ of the males are dilated. The males of many Eulophi and other genera have beautifully branched antennæ. In Dicladocerus *Westw.* (Frontispiece, vol. i. *fig.* 4.) and Eulophus dicladus (Say, *Journ. Boston N. H. Soc.* vol. vi. p. 273.) the antennæ of the males are 2-branched; in Eulophus they are 3-branched; in Tetracnemus *Westw.* they are 4-branched; in Pentacladia *Westw.* they are 5-branched; in Chirocerus they are 7-branched; and in some male Thoracanthæ, 9-branched. The maxillary palpi of the males of Pachylarthrus *Westw.* are terminated by a very large globular joint (*fig.* 77. 10.); and the Rev. A. Matthews has recently discovered several curious species in which both the maxillary and labial palpi are thus constructed. Some of the species of the Pteromalides and Encyrtides are apterous, which is also the case with the females of my genus Theocolax. A curious peculiarity exists in one at least of these apterous species, which has been noticed by no previous author, and of which I am not aware of any analogous case in the order, namely, Choreius ineptus *Westw.* (Encyrtus i. Dalm.), which, although ordinarily found in an apterous state, was discovered by me in considerable numbers, in the hot autumn of 1835, with wings.

These insects, which are generally of the most splendid metallic colours, and of which the majority do not exceed a line or two in

length, are parasitic upon other insects in their early states* : some, from their minute size, are reared within the eggs † of other insects (ex. gr. Pteromalus ovulorum, and bifasciatus, Chrysolampus tristis, Cynips Bombycum *Fonscol.*, &c.) ; but the majority infest other larvæ or pupæ. They are especially destructive to Lepidoptera ; but they equally attack the species of some of the other orders — Coleoptera, Hemiptera, Orthoptera, Hymenoptera, and Diptera. Perilampus micans was always observed upon posts perforated by Lyctus canaliculatus and Hister picipes by Dalman ; and I have observed Perilampus angustus on palings perforated by Anobia. Cheiropachus quadrum feeds upon the larva of Hylesinus oleiperda according to Fonscolombe, and upon Hylurgus ; and C. pulchellus upon Hylurgus piniperda. (Cooper, in *Ent. Mag.* vol. ii. p. 116.) Eulophus chrysomelæ *Es.* (Pterom. gallarum *Fonscolombe*) was reared from the pupa of a Chrysomela by the latter, and Pteromalus galerucæ from the eggs of Galeruca calmariensis. Mr. Curtis has reared a species from Endomychus coccineus ; and M. V. Audouin has obtained Encyrtus flaminius *Dalm.* from Coccinella 7-punctata. Esenbeck also reared two individuals of Eupelmus annulatus from the pupa of Cryptocephalus 12-punctatus. (*Hym. Mon.* vol. ii. p. 76.) Pteromalus curculionoides *Bouché* feeds upon the larva of Gymnaetron villosulus.

Many species of Encyrtus, and those of my genus Coccophagus, infest the species of Coccus. Pteromalus aphidis *Bouché* attacks Aphis graminis ; M. Audouin has reared Mesosela elongata *Wlk.* from Aphides of the sweet pea ; and I have reared Agonioneurus subflavescens *Westw.* from those of the lime. Pteromalus apum is parasitic gregariously in the nest of the mason bee. (*De Geer*, t. ii. tab. 30. f. 29. 31.) A brood of Encyrtus varicornis was obtained by Esenbeck from a cell of Eumenes coarctata. (*Hym. Mon.* vol. ii. p. 219.) Réaumur has described and figured (*Mém.* tom. vi. pl. 20. fig. 2., and pl. 21. fig. 3.) a species of Chalcis, which is parasitic in the nests of the American wasp (Epipone nidulans), and which he regarded as the female of the wasp. Latreille incorrectly gives it as C. annulata, which is parasitic upon the pupæ of American Phalænæ. It is the C. pyramidea *Fab.* ; and some specimens discovered by Mr. Sells have enabled me to communicate a figure and description of the

* Esenbeck says of Pteromalus salicis, that it not only inhabits the galls of Salix aurita, but "quod sane mirandum, etiam gignere partu suo videtur."

† Fonscolombe obtained five or six specimens of his Pteromalus ? atomos from a single egg of a Lepidopterous insect : and see Bonnet, *Mémoires*, Observ. 36.

species to the Entomological Society. I have repeatedly captured Monodontomerus obsoletus flying about and entering the holes in walls made by Osmiæ for their nests, in which they were evidently about to deposit their eggs; and such is the account of their habits given by Fonscolombe. (*C. ænea.*) An exceedingly interesting species has been communicated to me by M. Audouin, which he discovered to be parasitic in the provisioned nests of Odynerus, Anthophora, and Osmia. The male has most singular antennæ, and minute rudiments of wings, so that it does not quit the cell; but the female, having been there impregnated, is enabled, by means of her full-sized wings, to seek other cells for her progeny. The species has not yet been described. Eurytoma plumata *Ill.* is parasitic upon the parasitic larva of Microgaster liparidis *Bouché* (*Naturg. Ins.* vol. i. p. 166.); and Pteromalus Braconidis *Bouché* infests the parasitic larvæ of Rogas linearis.

Eupelmus Syrphi *Bouché* (Ceraphron *S.*) infests the larvæ of Syrphus Ribesii and balteatus. (*Nuturg. Ins.* p. 175.) Pteromalus micans *Oliv.* is parasitic upon Dipterous insects which attack the wheat. (Olivier, *Première Mém. sur quelques Insectes qui attaq. les Céréales*, 1813.) Many species infest the larvæ of gall-forming Cecidomyiæ, as the Eulophus cecidomyianus *Bouché*, and Eulophus ericæ *L. Dufour.* (*Ann. Soc. Ent. de France*, 1837, p. 91.) The larva of Spalangia nigra is parasitic upon the pupæ of Musca domestica, devouring the intestines. The Ceraphron destructor of Say, which is parasitic upon the Hessian fly in America, is evidently one of the Eulophides, from the structure of the antennæ and wings, as represented in his figures. (*Journ. Acad. N. H. Soc. Philadelphia*, 1817.) M. Audouin has communicated to me specimens of a curious genus, allied to Palmon, which he extracted from the egg-case of a species of Mantis, sent from the Isle of France by M. Julien Desjardins. I have also received from Dr. Klug another allied species, obtained from the egg-case of a Brazilian Mantis.

The attacks of species of these insects upon the egg-case of Blatta have been alluded to in vol. i. p. 423.

The species of the genus Chalcis vary very materially in the nature of the insects which they attack: thus, whilst C. xanthostigma *Dalm.* was reared from the pupa of species of Hylotoma, C. flavipes was obtained from the pupæ of Lepidoptera by Fonscolombe, and C. annulata from the pupæ of American Phalænæ by Dr. Pflug. Dr. Klug describes a

species, C. albicrus, from the pupa of Euplœa Chrysippus (*Symb. Phys. Ins.* pl. 37. f. 9.); and I have described another species, of which twenty-one specimens were obtained from a pupa of an East Indian Euplœa. (*Ent. Trans.* vol. ii. p. 5.) Say obtained Chalcis amœna from the pupa of a Thecla (*Journ. Boston Nat. Hist. Soc.* vol. i. p. 271.); and Giorna, C. minuta, from Zygæna filipendulæ; whilst C. pyramidea infests the nests of Epipone nidulans.

Some species, especially those having the ovipositor long and exserted (G. Callimome), deposit their eggs in various kinds of galls*, formed by Cynipidæ, Cecidomyia, &c.; their progeny attacking and subsisting upon the larvæ inclosed within. Thus, a beautiful species of Eulophus (E. Nemati *Westw.*), although having a concealed ovipositor, deposits its eggs in the galls of Nematus gallicola; the parasitic larvæ attaching themselves to the outer surface of the body of their victims. It is generally, however, *within* its body that they take up their abode: thus, Pteromalus puparum undergoes all its transformations within the bodies of the caterpillars and chrysalides of some species of butterflies, bursting forth out of the body of the latter† in vast numbers in the winged state. De Geer records the curious circumstance, that male parasites alone were produced, in considerable numbers, from one leaf-rolling caterpillar, and only females from another (*Mém.* i. 583.); and Kirby and Spence (who erroneously regard this species as identical with Pteromalus puparum, in which they have been followed by Mr. Walker, *Ent. Mag.* iii. 204.) hence conjecture, that, as in the Queen Bee, the eggs producing the two sexes were arranged separately in the ovaries. De Geer, however, regarded it as accidental; and such must evidently have been the case; for out of one chrysalis of Vanessa urticæ I have obtained at least 20 males and 36 females of Pteromalus puparum; and Mr.

* Several species of Eurytoma having been observed to be attached to different kinds of galls (but evidently for the purpose of feeding upon the real inhabitant thereof), Esenbeck considered that genus as more properly belonging to the family Cynipidæ (*Hym. Monogr.* vol. ii. p. 39.).

† Kirby and Spence (*Introd.* vol. iv. p. 223.) state, that Callimome Puparum commits its eggs to the chrysalis of the butterfly (Vanessa urticæ); the moment this caterpillar quits its skin to assume that state, while it is yet soft, they pierce it, and confide to it their eggs. Referring to *De Geer*, "vide supra" [or vol. i. p. 583.]; adding, "De Geer and others have supposed that this same species attacks the Cocci and Coccinellæ (*Ibid.* p. 883.); but this probably is an erroneous supposition." There is apparently some error in these references, as I can find no such passages in De Geer.

Walker obtained 82 males and 26 females from one chrysalis. I have also reared both sexes of Eulophus Nemati from larvæ infesting the same individual; and Dalman mentions an instance in which more than a hundred individuals were produced from a single Lepidopterous larva, of moderate size. These parasitic larvæ have, of course, the same instinct as those of the Ichneumonidæ, not to touch the vital parts of their victim until the last.

Other species, whilst still larvæ, burst out of the body of the caterpillar before it has assumed the pupa state, and attach themselves either to the exuviæ of their victim, or to the adjacent foliage, by means of a glutinous secretion, as in the species of Eulophus observed by Geoffroy (*Hist. Ins.* vol. ii.; Réaumur, *Mém.* tom. ii. pl. 36. f. 9, 10.; De Geer, *Mém.* tom. ii. tab. 31.; Kirby, in *Trans. Lin. Soc.* vol. xiv. Euloph. damicornis; Say, *Journ. Boston N. H. Soc.* vol. i. Eul. basalis; Vallot, in *Ann. Soc. Ent. de France*, 1834, p. 64. Append. Eulophus).

Some species are recorded to be parasitic upon other parasitic insects: thus, Chrysolampus suspensus *Es.* perforates, first, the body of Aphis rosarum, and secondly, the body of the enclosed parasite, Aphidius varius, destroying the latter; and Mr. Newman has described the economy of a species of Pteromalus (P. omnivorus *Wlk.*), which, in like manner, attacks the internal parasitic larva of Exorista larvarum. (*Mag. Nat. Hist.* No. 25. vol. v. p. 252.)

The larvæ are minute apodal grubs, generally of a whitish colour, and fleshy consistence; of an elongate-oval form, attenuated at the posterior extremity, and with slight indications of articulation. *Fig.* 77. 18. represents the larva of a Callimome, after Rösel, and *fig.* 77. 21. that of Eulophus Nemati *Westw.*

The larva of Spalangia nigra is described by Bouché as being of an ovate form, but fusiform when extended; white, soft, with a very transparent skin, showing the intestines. The head is small, rather rounded, situated at the obtuse end of the body, and retractile within the thoracic segment, which is very irregular and variable in its form. On the under side of the body each segment has two pellucid tubercles, forming the substitutes of a double row of legs. (*Naturg. Ins.* p. 173.)

The pupæ of this family are especially interesting, from exhibiting a much nearer approach to the obtected pupæ of the Lepidoptera than is made by any other Hymenoptera. The general form of the body

is that of the imago; but the limbs are closely laid upon the sides and breast, to which they appear to be firmly soldered (*fig.* 77. 22. pupa of Eulophus Nemati, *fig.* 77. 23.). The pupæ of those species which have the ovipositor long and exserted, have this instrument bent over the back (*fig.* 77. 19. pupa of Callimome, *fig.* 77. 20.). The pupa is ordinarily black or brown, although at first of a pale fleshy white. Mr. Haliday (*Ent. Mag.* No. 8. p. 225.) states that some of the petiolated Pteromali (Microgasteridæ *Wlk.*) have the pupa bent double; but these do not inflect the abdomen in oviposition.

The majority of these insects pass the inactive period of their existence naked, and not enclosed in a cocoon. Esenbeck, however, states, in the general characters of the family, "*Pupa* vel nuda, vel tela laxiori involuta, chartacea" (*Hymen. Ichn. Aff. Monogr.* vol. ii. p. 6.); and in a subsequent page he describes the proceedings of Euplectrus albiventris *W.* (Microterus albiventris *Spin.*; Elachertus a. *Esenb.*; Euplectrus maculiventris *Westw.* olim; Spalangia flavipes *Fonscol.*; Pteromalus bicolor *Swed.* (?); Eulophus b. *Walker*), which species infests the caterpillar of Noctua trapezina, out of which the larvæ burst forth and spun a white thread, in which they inclosed the exuviæ of their victims, and beneath which they then underwent their own transformations. (*Hym. Mon.* vol. ii. p. 136.)

M. Boyer de Fonscolombe (to whom I am indebted for specimens of the majority of the species described by him) has also forwarded to me drawings of this insect (under the name of Spalangia flavipes) in the larva and imago state; the former being represented as externally feeding upon a large Lepidopterous larva. His description of this larva differs somewhat, in regard to its habits, from that given by Esenbeck. It is as follows: — "Larva erucarum corpori externi firmiter extremâ suâ parte affixa, apoda (ut mihi visum) ovato-subgibbosa, transverse plicata, ore non distincto, griseo-virescens, sic cum eruca crescit, eam paulatim consumens; ad metamorphosin filis aliquot sericis longiusculis crispis inordinatis involvitur."

Mr. Haliday also describes the economy of Coruna clavata, which is parasitic upon one of the Aphidii, which is parasitic upon an Aphis. The larvæ of the first-named parasite, not content with the covering which protects the Aphidius to its final change [namely, the dried exuviæ of the Aphis], when they are full fed, leave the cavity, and spin a white silken web between the belly of the Aphis and the leaf, and in this they undergo their transformation. (*Ent. Mag.* vol. ii. p. 99.)

In the perfect state, they are abundantly met with amongst the foliage and herbage of various kinds. They are easily taken with a sweeping-net, and should be captured in quills or pill-boxes, killed in boiling water, and arranged, with the limbs extended, on gummed card-paper.

Amongst the exotic species are especially to be noticed those composing the genus Leucospis *Fab.*, which are the giants of the family, having the anterior wings longitudinally folded when at rest; the abdomen of the females (*fig.* 77. 7.) compressed, with the ovipositor recurved over the back when at rest, with a spiracle at each side of the fifth joint; the hind femora incrassated, and dentated beneath. The species, of which several are natives of Southern Europe, are varied with black and yellow, somewhat resembling small wasps: the abdomen of the males is 3-jointed, and of the females 5-jointed.

The female of L. dorsigera *Fab.* is stated by Latreille to deposit its eggs in the nests of some species of Mason Bees; whilst that of L. gigas is stated to oviposit in the nests of Wasps: but the curious observations stated by Latreille (*N. Dict. Hist. Nat.* xvii. 513.) to have been made upon its history by the Comte de Saint Fargeau have not yet been published. This gentleman has, however, communicated to me an account of the mode of its oviposition: the female elevates itself on the tips of its tarsi upon walls close to the nests of the Mason Bees; and by degrees, it depresses the ovipositor, and bends it forwards beneath the body and between the legs, protruding it beyond the head, and inserting it into the nest. This account, therefore, proves the incorrectness of the suggestion of M. Biguet, conveyed in a letter to M. Giorna (*Calendario Entomologico*, p. 118.), that, from the dorsal position of the ovipositor, it is most probably in the nests of the common Earth Wasp (the cells of which are open on the under side) that it oviposits. (For descriptions of the species of this genus, consult Klug's *Monogr.* above referred to; Walker, in *Ent. Mag.* vol. ii. p. 20.; Fonscolombe, Spinola, Fabricius, Jurine; my Memoir in *Ent. Mag.* vol. ii. p. 213., and a monograph forwarded by me to Dr. Klug for the 2d part of his *Jahrbucher*, containing descriptions of thirty-six species; Ahren's *Fauna*, fasc. 2.; and Say, in *Boston Journ. of Nat. Hist.*)

The genus Thoracantha *Latr.* consists of various exotic species having the mesothoracic scutellum very greatly developed, and extended over the abdomen, concealing the wings when at rest, as in the

Scutelleridæ. I am acquainted with upwards of twenty species of this genus, some of which are the most remarkable insects of the order, and of which I am preparing a monograph.

The genus Agaon *Dalm.* is remarkable for the large size of the flattened head, and the triangularly dilated basal joint of the antennæ, which are terminated by three thickened joints, forming an elongated mass. The collar is greatly elongated and depressed, thus nearly approaching the Coleoptera, and rendering the type of this genus (A. paradoxum *Dalm.*) one of the most singular of Hymenopterous insects. (MacLeay, in *Zool. Journ.* No. 18. p. 166.) It inhabits Sierra Leone; and a specimen of it has been recently presented to the British Museum. This genus is closely allied to some singular insects which are employed in the Levant in the process of caprification; the insects being induced to deposit their eggs in the seed-vessels of the wild figs, which, being the earliest, are subsequently plucked, and placed in the neighbourhood of those of a later growth; when the flies, escaping from the former, immediately introduce themselves, covered as they are with the fecundating powder, into the eyes of the latter; thus impregnating them, and causing them to come to perfection earlier than they otherwise would do. Such is the account of the process given by some authors; but Lindley (*Penny Cyclop.* vi. 273.), Decandolle (*Physiol. Végét.* p. 580.), Treviranus (in *Linnæa*, 1828, with figure of the insect), and other vegetable physiologists, attribute the earlier ripening of the otherwise later crop, and the opportunity thus afforded to the fig-growers in the Levant to obtain a double crop in a season, to the well-known fact, that fruit bitten by insects ripens sooner than others, the wound (and not an act of impregnation) appearing to act as a stimulant to the local action of the parenchyma. (See also *Linn. Amœn. Acad.*, and Hasselquist, *Iter in Palestinam.*) The species of insect employed for this purpose is the Cynips psenes *Linn.* (G. Blastophaga *Gravenhorst*), and Sycomori. I have also received from Dr. Klug another species "ex ficubus Ægypti," which I have described in a memoir upon these insects, under the name of Sycophaga crassipes. I am also indebted to Dr. Klug for a species of larger size, allied to Chalcis, and especially to Palmon *Dalm.*, also obtained from Egyptian figs.

In the works of Réaumur (*Mémoires*, tom. ii. mém. 11., and tom. iii. mém. 12.), De Geer (*Mémoires*, tom. i. and ii.), Rösel (*Abhandl. Ins.* vol. ii. tab. 3., and vol. iii. tab. 53. and 69.), Frisch, Gödart, Christius,

and other early authors, we find various species of this family described, and their economy detailed; but, generally, the species are so vaguely described, that it is impossible to determine them with precision.

Geoffroy first proposed the genus Cynips (distinguished from the Gall Flies, or Diplolepis) for the reception of the smaller species with simple legs; and Swederus subsequently, in the *Swedish Transactions*, 1784, established another genus under the name of Pteromalus.

Latreille and Illiger added to these genera; but it is to Spinola that we are indebted for the first attempts at a more perfect arrangement. More recently, Dalman and Boheman in Sweden, Fonscolombe in France, Nees Von Esenbeck and Bouché in Germany, and Walker, Curtis, Haliday, and myself in England, have devoted much attention to these minute tribes; Mr. Walker having described nearly 1200 British species.

Spinola employed as his chief characters for the distribution of this family into sections, first, the number of joints of the antennæ, and secondly, the form and mode of attachment of the abdomen; both of which, it must be admitted, are characters of too slight value. Dalman adopted the form of the antennæ, legs, and veining of the wings; whilst Latreille employed those of the form of the hind legs, collar, and mandibles. Mr. Walker, on the other hand, by attaching too great importance to the form of the stigma and its branch, and the form of the abdomen and its attachment to the thorax, has formed a number of families, such as the Torymidæ, Miscogasteridæ, Ormoceridæ, Cleonymidæ, &c., which I have not thought it necessary to retain. With the exception of a few genera, osculant and anomalous, the family, after the removal of Scelio, Teleas, &c., which evidently belong to the Proctotrupidæ, is naturally divisible in the following manner:—

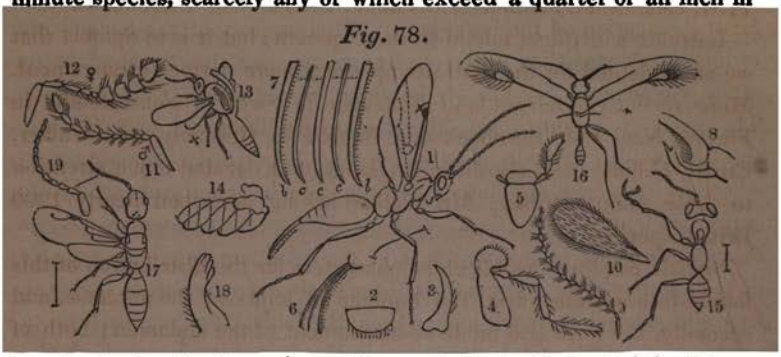
1. Collar transverse quadrate.
   - A. Hind femora incrassated. (Subfam. 1. Chalcides.)
   - B. Hind femora simple. (2. Eurytomides.)
2. Collar less evident, more or lees narrowed in front.
   - A. Antennæ with more than eight joints.
     - *a.* Middle legs simple. (3. Pteromalides.)
     - *b.* Middle legs strongly spurred. (4. Encyrtides.)
   - B. Antennæ with not more than eight joints; tarsi with less than five joints. (5. Eulophides.)

These subfamilies are connected together by many very interesting links; as, for instance, Pleuropachus costalis, Tetracnemus diversicornis, and several other genera which I have described, form various

points of connection between the Encyrtides and Eulophides; whilst Eupelmus and some allied genera, in like manner, connect the Pteromalides and Encyrtides.

The family PROCTOTRUPIDÆ* *Stephens*† (Codrini *Dalman*; Psilotes *Fallen*; Oxyuri *Latreille*) consists of an extensive assemblage of minute species, scarcely any of which exceed a quarter of an inch in

Fig. 78.



length; having the fore-wings either entirely destitute of (*fig.* 78. 10. fore-wing of Diapria), or with but very few, veins, the posterior pair being also veinless. The body is generally longer and more slender than in the Chalcididæ (*fig.* 78. 1—7. Proctotrupes brevipennis *Latr.*

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* BIBLIOGR. REFER. TO THE PROCTOTRUPIDÆ.

Shaw, in Trans. Linn. Soc. vol. iv. (Ichneumon punctum. *Mymar.*)
Kirby, in Trans. Linn. Soc. vol. iv. (Ichneumon Tipulæ. *Platygaster.*)
Klug, in Weber's Beitrage zur Naturkunde, vol. ii. 1810. (Pristocera.)
Dalman, in Swed. Trans. 1818, and in Analecta Entomol. (Dryinus.)
Ljungh, in Weber's Beitrage zur Naturkunde, vol. ii. 1810. — Ditto, in Swedish Trans, 1823.
Haliday, in Entomol. Mag. No. 4.
Walker, in Ent. Mag. No. 18. (Platygaster.) — Ditto, in ditto, No. 14. (Teleas, &c.) — Ditto, in ditto, No. 20. (Gonatopides. Dryinus.)
Esenbeck. Hymenopt. Ichn. Affin. Monogr. vol. ii. 1834.
Say, in Annals Lyceum Nat. Hist. New York, vol. i. — Ditto, in Journal of Boston Nat. Hist. Soc. vol. i. p. 3. 1836.
Westwood, in Taylor's Phil. Mag. August 1832, June 1833, November 1833. — Ditto, in Trans. Entomol. Soc. vol. ii. p. 56. (Calyoza and Caloteleia). — Ditto, in Mag. Nat. Hist. Sept. 1833. Nov. 1833. — Ditto, in Proceed. Zool Soc. April 1835, and May 1835.
Latreille, Curtis, Jurine, Panzer, Fabricius, Spinola.

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* As the genus Proctotrupes was proposed in the *Précis des Caract. Génér.* in 1796, it must have priority over Jurine's name Codrus.

♀ and details). The antennæ are variable in length, being in the males of some species nearly as long as the body (as in *fig.* 78. 16. Mymar pulchellus ♂): they consist of from 10 to 15 joints, the basal joint being the longest, and not carried upwards; the antennæ, although occasionally elbowed at the extremity of this joint, never being so much geniculated as in the Chalcididæ: the three terminal joints are not compactly soldered together, and the front of the head is not impressed for the reception of the basal joint. The antennæ of the females are ordinarily shorter than those of the males, with the terminal joints often thickened (*fig.* 78. 11. antenna ♂, 12. ditto ♀ Platygaster). The labrum is minute (*fig.* 78. 2.); the mandibles are longer than in the Chalcididæ, variable in form, but in the majority they are somewhat sickle-shaped, and notched at the tip: in Proctotrupes they are entire and acute (*fig.* 78. 3.); the maxillæ are terminated by a large thin membranous lobe (*fig.* 78. 4.): the maxillary palpi are variable in the number of their joints from three to six; they are often, however, long and pendulous, much longer than the labial palpi, and filiform or setaceous; the mentum is horny or leathery, and compressed; the labium is entire, and often retracted within the channelled inside of the mentum in dried specimens; the labial palpi are short, and generally 3-jointed, the terminal joint being the largest (*fig.* 78. 5.). The eyes are entire, the ocelli generally 3 in number. The thorax is of an oblong form, with the divisions ordinarily well defined, the tegulæ in some species being very large: the wings are ordinarily ample; but in some species they are wanting, or only rudimental*; the posterior in some species are furnished at the base with a small lobe. The legs are long, the femora often slightly clavate, the anterior tibiæ furnished with a terminal curved spur, which is sometimes bifid, the basal joint of the anterior tarsi having a deep incision at its base inside, which is serrated (*fig.* 78. 8. from Cinetus). The tarsi are 5-jointed, except in the genus Iphitrachelus *Hal.*, in which they are 4-jointed. The abdomen is generally of an ovate-conic form, with five, six, or seven distinct segments; this part of the body is terminated in some species by a curved, elongate, conic, and acute ovipositor (as in *fig.* 78. 1.); whilst in others the ovipositor is retractile within the extremity of the abdo-

* Jurine (*Nouv. Méth. Class. Hymenopt.* p. 304.) has expressed the opinion that these individuals had pulled off their wings like ants after the period of swarming; having observed some specimens which had only "des restes de ces parties," and that the entirely wingless ones were neuters; but these "restes" of wings never exhibit any signs of mutilations, and as the species are not social, they cannot be neuters.

men, and formed, according to Latreille, of two valves composing a tube, and inclosing the true needle-like ovipositor: in the former the ovipositor appears at first sight simple, but is most probably formed of two valves closely united together, two sutures being perceivable. In the Gonatopides, Bethyllus, &c., the ovipositor is affirmed by Esenbeck to be converted into a true sting. My figures 78. 6. and 7. represent the composition of the ovipositor in Proctotrupes brevipennis. In 78. 6. the two demi-sheaths are partially extended, showing the ovipositor, which is defended by them when shut together. In 78. 7. the various parts are entirely separated, *b* and *b* representing the demi-sheaths, c the ovipositor itself channelled on the under side, and *c c* the two spiculæ playing in this channel, and which it will be seen are thus the representatives of the parts delineated with the same letters in the figures illustrating the Uroceridæ, Cynipidæ, and Ichneumonidæ.

Many of these insects are exceedingly active, running and flying with great agility; but few are capable of leaping. They are of very minute size, some being so minute as to be visible only to the naked eye when creeping up the glass of windows opposed to the light (Ichneumon [Mymar] atomos *Linn.*; Ichn. punctum *Shaw, Trans. Linn. Soc.* vol. iv. pl. 18. f. 1. Mymar Monas, Termo, &c.). Their colours are ordinarily black, varied with pitchy or brown. They may be taken in great numbers upon grass and other vegetables in the sweeping-net. Some frequent hot sandy situations, as Gonatopus *, Epyris †, &c., whilst others are found upon aquatic plants (as Thoron solidus *Es.*, metallicus *Hal.*). I have observed that some species have a curious habit of alternately raising and depressing the abdomen when standing still upon hot sand-banks. They are parasites, but the transformations of very few species have been observed. Latreille, indeed, supposed that, as many of them are found on the ground and upon low herbs, their larvæ reside in the earth. It is, however, more probable that they deposit their eggs in other insects residing in such situations.

* I have occasionally taken Gonatopus in damp situations, but generally in exposed hot sandy localities. Mr. Haliday generally finds it on the sand hills of the coast, and Mr. Paget in similar situations near Yarmouth. (See his *Nat. Hist. Yarmouth*, Appendix.)

† I have repeatedly taken Epyris niger flying over hot sand-banks, both at Coombe Wood and near Bingen on the Rhine, just in the same manner as fossorial Hymenoptera.

In a few instances which have fallen under my observation, the pupæ are inclosed in a cocoon.*

I have reared one of the small species of Megaspilus *Westw.* (Ceraphron Carpenteri *Curt.*) from Aphides from the bean. And Bouché has described another species of Ceraphron (C. Syrphii), the larva of which is long and white, with the parts of the mouth brown, and which infests the pupæ of Syrphus Ribesii and balteatus. (*Naturg. d. Ins.* p. 175.)

The species of Platygaster are serviceable in checking the overproduction of some of the minute Tipulideous insects which infest the cerealeous plants, such as Cecidomyia. Mr. Kirby (*Linn. Trans.* vol. iv. and v.), has detailed the habits of two species of this genus, Pl. Tipulæ, which is found on the glumes of the wheat in July, where it deposits its eggs in the larvæ of the Cecidomyia Tritici; and Pl. inserens, which is found in June depositing its eggs in the valvules of the corolla of the wheat, the larvæ, when hatched, probably attaching themselves to the larvæ of the same insect. Pl. phragmitis *Schrank* inhabits the panicles of Arundo phragmitis, evidently with a similar object. I have reared two species of Platygaster, which are parasitic upon the gall-making Cecidomyiæ of willows, and observed that their cocoons, which are very thin and membranous, are attached together in a mass, and covered by the thin skin of their victim, the segments of which are slightly visible across the surface (*fig.* 78. 14.); and Bouché has described a Diapria, which is parasitic on the larvæ of Cec. Artemisiæ (D. Cecidomyiarum).

The Canon Schmidberger has published a very detailed account of the habits of Inostemma Boscii, under the name of Die paradoxe Birn-Wespe, in Kollar's work upon obnoxious insects (*Verhandl. Landwirthsch.-Gesellsch. in Wien,* vol. v. 1837), asserting that it feeds upon the young fruit of the pear, and is certainly not parasitical, although he had observed the transformations of one of these gall midges in

* De Geer has figured a minute black species with dirty white legs, which he reared from minute cocoons attached together side by side, found in the burrow of the larva of one of the pear-leaf miners. The figure has somewhat the air of an Encyrtus; but the pupæ are naked in that genus. Can it be a Platygaster? or is it one of the Eulophides, as the antennæ seem to imply? (*Mém.* tom. i. pl. 30. fig. 14—17.) He has also figured on the same plate another minute black species with a large black stigma, which infests the larvæ of rose-leaf miners. The antennæ are described as very long and multiarticulate, which would prevent this from being a Megaspilus, although the size of the abdomen is too large for a Microgaster (pl. 30. fig. 21.).

the same fruit. I am enabled to give the systematic name of this curious insect described by Schmidberger, having received specimens of both sexes from him through Messrs. Kollar and Loudon.

The species of Teleas and its subgenera are parasitic on the eggs of other insects, especially in those of Lepidoptera. Zinannius also observed one of the species depositing its eggs in the eggs of one of the Cimicidæ (*Schrank*, No. 761.). M. V. Audouin has also reared several minute species of Teleas from the eggs of Pentatoma ornatum, as well as from the eggs of Lepidopterous insects. The type of this genus is the Ichneumon ovulorum *Linn.* (Teleas Linnæi *Esenb.*), which Linnæus and De Geer obtained from the eggs of moths. Another species, confounded with the preceding (T. ovulorum *Esenbeck*), was also reared by Goetze and Esenbeck from the eggs of moths (Gastropacha castrensis). Bouché observed the female deposit an egg in each of the eggs of a brood of Bombyx neustria. He describes the larva as elliptical, white, shining, rugose, subincurved, and one-third of an inch long (*Naturg. Ins.* p. 177.).

Mr. Haliday, regarding the Ichneumon ovulorum *Linn.* as a Mymar, observes upon that group, " The females oviposit in the eggs of other insects, from which the tiny parasite emerges only in the perfect state, a single butterfly's egg often nourishing the transformation of many individuals." (*Ent. Mag.* vol. i. p. 342.)

A species of the same genus (Teleas truncatus *Es.* ii. 288.) was reared by Esenbeck from a gall of Cynips Quercûs Gemmæ. The same author considers that the Diapriæ are parasitic upon the larvæ of the Tipulidæ terricolæ, whilst those of Belyta, Codrus, Cinetus, &c., which are often found in fungi in the autumn, are parasitic upon the larvæ of the Tipulidæ fungicolæ ; indeed he reared Proctotrupes parvulus from Boletus circinans, which was much infested by the larvæ of a Mycetophila. (*Hym. Mon.* vol. ii. p. 316. 353.)

Mr. Haliday has given a very interesting account of the habits of the genus Bethylus, which buries the larvæ of some species of Tinea, which feed upon the low tufts of Rosa spinosissima, dragging them to a considerable distance with great labour and solicitude, and employing, in the instance recorded by Mr. Haliday, the bore of a reed stuck in the ground instead of an artificial funnel, for the cells which should contain the progeny of the Bethylus, with its store of provision. (*Ent. Mag.* No. 7. p. 219.) *Fig.* 73. 17. B. fuscicornis, 18. mandible, 19. antenna of ditto.

This family exhibits a singular diversity of structure in many of the species, and of which we meet with nothing analogous throughout the order. Thus, in the subfamily Mymarides, the wings are ornamented with very long marginal bristles; and in two of the species (Mymar pulchellus, *fig.* 78. 16., and a species discovered by the Rev. A. Matthews), the fore-wings are very long, consisting only of a long linear branch, dilated and spatulate at the tip. In some species of the Platygasterides, Plat. (Inostemma *Hal.*) Boscii *Jurine*, &c. (*fig.* 78. 13.), the basal segment of the abdomen of the females is furnished with a thick curved horn, which extends over the back of the thorax and head (and which Le Clerc de Laval thought was the sheath of the ovipositor, but evidently incorrectly). Some of the species have one or more of the basal joints of the antennæ singularly nodose or dilated, and in the genus Diapria the males have all the joints nodose and beautifully verticillated (*fig.* 78. 9.). In the genus Galesus *Curtis* (Psilus cornutus *Panzer*) the head is produced beneath into a long rostrum, formed by the elongated mandibles; and in some specimens of this genus the anterior wings have a notch at the extremity. Such is the case in one given to me by Latreille under the name of Psilus cornutus; and Say has described a genus with similar wings under the name of Coptera. (*Boston Journ. Nat. Hist.* vol. i.). In Gonatopus * the females (*fig.* 78. 15. G. pedestris) are apterous, with the thorax singularly constricted, and the anterior tarsi (as well as in the females of Anteon) are terminated by curious large reflexed claws, which open and shut like those of a lobster, which Esenbeck (who forms these insects into a distinct family, Dryinei, on account of the structure of the sting-like ovipositor) thinks may be used to enable them to seize and retain hold of insects to be by them carried into their already provisioned nests.

From this great diversity of structure, the present family necessarily presents many points of relationship with other groups. Thus Latreille, in his earlier works, followed more recently by Esenbeck and Boyer de Fonscolombe, introduced the genera Platygaster, Scelio, and Teleas into the family of Chalcididæ†, chiefly on account of the paucity of joints in the palpi. Mr. Haliday, in like manner, regards

* Mr. Haliday has published an account of a curious encounter which he witnessed between Gonatopus pedestris and some ants. (*Ent. Mag.* No. 7.)

† Latreille evidently considered that these genera ought naturally to belong to the Proctotrupidæ, as we see by his observation, *Gen. Cr. &c.* vol. iv. p. 30.

the Mymarides as more nearly allied to the last-named family than to the present, relying on the structure of the thorax, and the position of the petiole; which, however, presents a marked peculiarity. (*Ent. Mag.* No. 4. p. 343.)

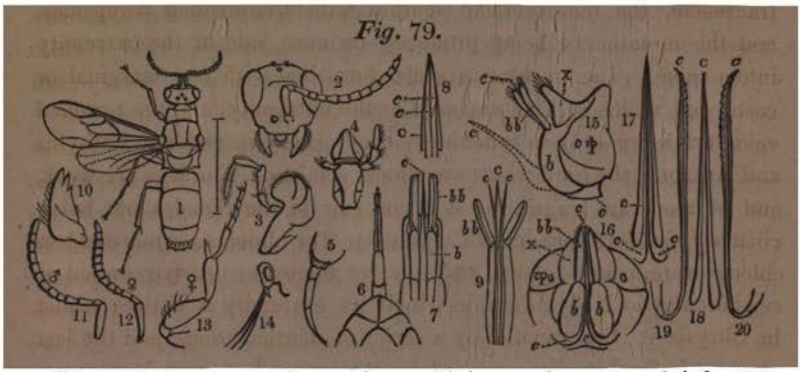
Proctotrupes, in the tubular form of the terminal joints of the abdomen, approaches the Chrysididæ; whilst Bethylus (Omalus *Jur.*) has the veins of its wings similar to those of Hedychrum, but in its habits it is more analogous to Stigmus amongst the Fossorial Aculeata, to which it is asserted to belong by Haliday (*Ent. Mag.* No. 3. p. 276.) and Walker (Ditto, No. 20. p. 411.). Some species, in the apterous condition of the females (Gonatopus, Scleroderma), resemble some of the Mutillidæ, as Methoca and Myrmosa; whilst Pristocera, Epyris, and some undescribed genera, make a very close approach to Meria and Tiphia amongst the Fossores.

Regarding the Mymarides as belonging to the Proctotrupidæ, on account of the diversity of the antennæ in the opposite sexes, and of the absence of veins of the wings (thus resembling Diapria, the family will comprise the six following subfamilies, corresponding with the divisions proposed by Mr. Haliday in the *Entomological Magazine*, vol. i. p. 269.: —

1. Mymarides. Head transverse areolate; antennæ inserted above the middle of the face, ♂ long, slender, and elbowed, ♀ clavate; mouth destitute of palpi; wings narrowed, densely ciliated, with a very short subcostal nerve.
2. Platygasterides. Abdomen sessile, depressed, first segment not campanulate; antennæ elbowed, 10- to 12-jointed, inserted near the mouth.
3. Ceraphrontides. Abdomen subsessile, campanulate, terminal and ventral segment carinated; antennæ elbowed, inserted near the mouth; wings nearly exareolate.
4. Gonatopides. Abdomen convex, not campanulate, last ventral segment carinated; antennæ porrected, 10-jointed; hind wings lobed; mandibles toothed.
5. Proctotrupides. Abdomen subsessile, campanulate; antennæ porrected, 12-jointed, inserted beneath the front; maxillary lobe bipartite.
6. Diapriides. Abdomen petiolated, campanulated; antennæ inserted in the front, 12- to 15-jointed; maxillary palpi long, 5-jointed.

The family CHRYSIDIDÆ *, or ruby-tailed flies (corresponding with the Linnæan genus Chrysis), is distinguished by having the abdomen attached to the thorax by a very short peduncle, and composed of only three, four, or five segments; the remainder being transformed into a tubular, retractile, telescopic-formed apparatus, the extremity of which is furnished with a minute sting, or ovipositor; the anterior wings have but few veins, and the posterior are nearly veinless. The under side of the abdomen is concave, and capable of being applied to the breast; so that, when alarmed, the insect rolls itself up into a ball.

Fig. 79.



The body is more or less oblong, shining, and punctured (*fig.* 79. 1—9. Chrysis ignita, and details); the head is transverse above (*fig.* 79. 2. face); the upper lip is more or less distinct, and ciliated in front; the mandibles are long, subtrigonate, simply incised in Chrysis, and varying in the number of teeth with which they are furnished in other genera (*fig.* 79. 10. mandible of Cleptes): the maxillæ are

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* BIBLIOGR. REFER. TO THE CHRYSIDIDÆ.

Le Pelletier Comte de Saint Fargeau, in Ann. du Mus. d'Hist. Nat. tom. xi. 1806. (Monogr. Chrysididæ with figures.) — Ditto, in Encyclop. Méthod. tom. x. p. 8. 493.

Dahlbom. Monographia Chrysididum Sueciæ. Lond. 1829.— Ditto, in Exercitationes Hymenopt. parts 2. and 3. 1831. (Monogr. Chrysididum Sueciæ.)

Shuckard, in Entomol. Mag. No. 17. (Monogr. British Chrysididæ.)

Curtis. Brit. Entomology, 2d Edition of No. 1. (Chrysis.)

Coquebert. Illust. Iconogr.

Klug, in Waltl. Reise nach Spanien. — (Ditto, in Ehrenb. Symbol. Phys. pl. 45. not yet published.)

Spinola. Insecta Liguriæ, vol. i. and ii.

Fabricius, Panzer, Rossi, &c.

terminated by a large pilose outer lobe, the inner lobe being smaller and slightly produced (*fig.* 79. 3.). The maxillary palpi are 5-jointed; the mentum is somewhat goblet-shaped, the labium membranous and more or less exserted, with the sides turned up in dried specimens (*fig.* 79. 4.): the labial palpi are short, and 3-jointed. The antennæ are filiform (*fig.* 79. 2.), elbowed at the extremity of the long basal joint, and composed of 13 joints in both sexes (*fig.* 79. 11. antenna ♂, 12. ditto ♀ of Cleptes). The thorax is oblong, and somewhat cylindric, the segments of which it is composed being strongly determined, the collar and mesothoracic scutellum being large and transverse, the mesothoracic scutum with well-defined parapsides, and the metathorax being produced on each side at the extremity into a spine. The upper wings are furnished with one marginal or costal cell, which is often unclosed at the extremity, and the terminal veins are more or less indistinct; thus closely resembling Bethylus and Anteon: the hind wings are almost veinless. The legs are weak, and of moderate length, the anterior pair in the females not being ciliated (*fig.* 79. 13. fore-leg of Cleptes ♀). The abdomen is more or less oblong-ovate, convex above, and concave beneath; nearly rounded or semicircular in Hedychrum, in which its extremity is entire; whilst in Chrysis it is terminated by a series of denticulations, and the last segment is further distinguished by a transverse row of deep punctures. In Chrysis it appears to consist of only three segments; but in Parnopes the males have four, and the females three, abdominal segments; and in Cleptes the males have five, and the females four, joints. The other terminal retractile segments are capable of being protruded nearly to the entire length of the abdomen (*fig.* 79. 5.), and are furnished at the extremity in the males with the organs of generation, and in the females with a minute sting-like ovipositor*, defended by two compressed semi-cylindrical styles, of the same length as the ovipositor itself. My figure (79. 6.) represents the under side of the extremity of the body, with the terminal segments exserted. In *fig.* 79. 7. the extremity of this apparatus is more highly magnified, and exhibits the basal portion (*b*) and the terminal portion (*b b*) of the two valves, and the ovipositor enclosed between them (c). *Fig.*

* Latreille and especially Dahlbom describe this instrument as a sting; but it is unconnected with glands secreting a poisonous fluid, although the insect is able to puncture the flesh when handled.

79. 8. represents, still more highly magnified, the appearance of the last-mentioned organ, exhibiting, at c, the deflexed sides of the channelled ovipositor, and at *c c*, the two spiculæ enclosed in the canal on its under side; whilst *fig.* 79. 9. shows all these parts extended, and distinguished by the same letters as have been employed in the explanation of the construction of the ovipositor in the preceding families. The composition of the ovipositor itself has not been attempted by Latreille and Curtis; and the account given of its construction in Cleptes (namely, an aculeus, with one lanceolate valve beneath), by the latter author, must be erroneous. De Geer more minutely investigated its structure (*Mém.* tom. ii. pl. 28. f. 19, 20, 21., and pl. 29. f. 1, 2.), and proved its analogy with the true sting, which he figured, with its details, in the former of these plates.

These insects, although but of small or moderate size, are amongst the most splendid of our native species, being adorned with brilliant metallic tints, blue and green being the usual colours of the head and thorax, and fiery copper-colour, or ruby, that of the abdomen*: hence they have been called the humming birds amongst insects. They may be observed during the hottest sunshine flying and running with great vivacity over walls, palings, sand-banks, and occasionally upon flowers, especially of the Umbelliferæ (Kirby, *Linn. Trans.* vol. iv. p. 196. note), and upon the leaves of trees. They are constantly in motion, keeping their antennæ in perpetual vibration, varying from tapping the surface of the object on which they are placed, to an almost imperceptible tremor.

In their economy there is some reason to believe that these insects differ from the preceding, and that they more especially deserve the name of cuckoo-flies; the females not depositing their eggs in the bodies of other insects, but taking an opportunity to deposit them in the nests of different bees, and other fossorial Hymenoptera, during the period when the latter are provisioning their nests for the support of their own progeny, which is thus starved by the intruder being first hatched and devouring the supply of food. Thus I have constantly found our largest British species in company with Odynerus antilope (see my article on the habits of this insect, in the *Trans. Ent. Soc.* vol. i.), of which it is doubtless the parasite, but which does not appear to offer the slightest molestation, deterred, possibly, as Latreille suggests, by

* A piscatorial friend tells me that these insects are famous baits for fishing; their colours, perhaps, being attractive to the fish.

the splendour of its coat of mail*; whilst C. bidentata frequents the burrowing places of Epipone spinipes, in company with that insect, especially on Barnes Common; whereas, were it the object of the Chrysis to deposit its eggs in the larvæ of those insects (which of course would not be produced until some time afterwards), the appearance of the two insects in the perfect state would not be simultaneous.

Dahlbom describes the larvæ of this family as somewhat resembling worms, and destitute of feet (*Exercit. Hymenopt.* p. 21.). I am indebted to Mr. E. Rudder for some particulars relative to the common species of Chrysis, which that gentleman reared from larvæ found in cells filled with Aphides, formed in the pith of an elder twig stuck into the ground. In this case, I apprehend, the nests were those of a species of Pemphredon, or some allied genus, and the Chrysis was parasitical in the nest: the mode in which the larva fed upon the Aphides (of which there were at least sixty in each cell) was observed by him; but it might certainly have been the larva of the maker of the nest which was thus occupied.

Mr. G. R. Waterhouse has also informed me that, in December, 1827, he found, in digging into a rotten post which had holes in it, at Coombe, several specimens of Chrysis ignita in the burrows; and on digging further he discovered a continuance of the burrow, in which were several cells filled with the skins of Aphides, no larva or pupa being present; so that it is not improbable that the Chrysides had been reared in these cells. De Geer discovered one of the species of this genus—his C. micans—in a resinous gall formed upon the pine; whence he was led to believe that its larva had been parasitic upon the caterpillar, which had been inclosed within it, because he found at the bottom of the hollow interior of the gall an empty cocoon, formed of a loose web of silk (which the Chrysis had pierced in order to make its escape), and also the exuviæ of the caterpillar which had disappeared. A correspondent of the *Entomological Magazine* (J. B. No. 25. p. 477.) reared specimens of C. bidentata and neglecta, in company with solitary wasps, from cells found in the earth, attached to the stump of a tree. Another correspondent of the same Magazine (Delta) asserts that Chrysis cyanea deposits her eggs in the cells of Chelostoma

* Latreille informs us that he had observed Chrysis ignita lurking about the cells of Philanthus apivorus, in order to deposit eggs in the nest of the latter, which, after perceiving the design of the Chrysis, chased it away. (*Mon. Fourmis*, p. 320.) Walckenaer states that the same species enters the burrows of Cerceris ornata, which are stored with a supply of a species of Halictus. (*Mém. Halictus*, p. 42.)

florisomne (a solitary bee); and that the larvæ produced from the eggs of the former feed on the larvæ of the Chelostoma, and undergo their metamorphoses in the cells prepared for these last * (*Ent. Mag.* vol. i. p. 387.) Saint Fargeau, however, who has more carefully examined the economy of these insects, states that the egg of the Chrysis does not hatch until the legitimate inhabitant has attained the greater part of its growth as a larva, when the larva of the Chrysis fastens on its back, sucks it, and in a very short time attains its full size, destroying its victim. It does not form a cocoon, but remains a long time in the pupa state. (*Enc. Méth.* tom. x. p. 9.)

In the 21st Number of the same Magazine (p. 77.) has been noticed the discovery of Hedychrum bidentulum, which appears to be parasitic upon Psen caliginosus; the latter insect had formed its cells in the straws of a thatched arbour, as many as ten or twelve cells being placed in some of the straws. "Some of the straws, perhaps about one in ten, contained one, or rarely two, of the Hedychrum, placed indiscriminately amongst the others." Walckenaer, in his Memoir upon Halictus (p. 33.), informs us that Chrysis [Hedychrum] lucidula waits at the mouth of the burrows of these bees, in order to deposit its eggs therein; and that when its design is perceived by the bees, they congregate together and drive it away.

M. le Comte de Saint Fargeau states, that the females of Hedychrum sometimes deposit their eggs in galls, whilst H. regium oviposits in the nest of Megachile muraria; and he mentions an instance in which the bee, returning to its nearly finished cell laden with pollen paste, found the Hedychrum in its nest, which it attacked with its jaws; the parasite immediately, however, rolled itself into a ball, so that the Megachile was unable to hurt it; it, however, bit off its four wings which were exposed, rolled it to the ground, and then deposited its load in the cell and flew away, whereupon the Hedychrum, now wingless, had the persevering instinct to crawl up the wall to the nest, and there quietly deposit its egg, which it placed between the pollen paste and the wall of the cell, which prevented the Megachile from seeing it. (*Enc. Méth.* tom. x. p. 8.)

* The passages connected with this history, published in 1833, in conjunction with others which appeared in the same work, recall to mind the existence of feelings which I am happy to say have long ceased. The date of my memoir upon the Chalcididæ, published in the *Zoological Journal*, and the amount of materials known to have been collected by me upon that family, and still intended for publication, are sufficient to show that they ought never to have been entertained.

The species of the genus Cleptes vary considerably in the colours of the opposite sexes, whence the males of the type have been named semiauratus, and the females aurata. I have found this insect very abundantly in gardens at Chelsea, in July and August, flying over and creeping upon the ground and low plants. Of the other British species, Saint Fargeau observes, " J'ai vu le Cleptes nitidule allonger beaucoup son tuyau auprès d'une larve de Tenthrède, et le pousser vivement contre elle. Quoiqu'il lui eût fallu pour cela recourber son abdomen et diriger ce tuyau entre ses pattes en avant de la tête, l'opération entière fut l'affaire d'une seconde." And in the *Encyclopédie Méthodique* (tom. x. p. 9.) he adds, " J'ai vu une femelle du Clepte semidoré entrer successivement à reculons dans les trous qu'avoient formés en s'enfonçant en terre un grand nombre de larves d'une Tenthrédine qui avoient vécu sur un même groseiller. L'année suivante je jouis à cette même place d'un spectacle fort brillant ; un centaine de males et quelques femelles de cette espèce, couroient dans tous les sens sur le petit espace de terrain ou les larves de Tenthrédine s'etoient cachées, et reflétoient toutes les couleurs des pierres précieuses. Ce spectacle se renouvela pour moi plusieurs jours de suite de dix à onze heures de matin ; ces individus dispersoient après cette heure, et je pense que ceux que je voyois chaque jour étoient nouvellement éclos dans cet endroit."

The exotic insects of this family are by no means of common occurrence ; indeed, Mr. Swainson, who collected the insects of this order assiduously during his travels in Brazil during several years, informs me that he discovered only one species of the typical genus Chrysis. Some Indian species are very brilliant (*Donov. Ins. Ind.*), as are also those of the genus Stilbum, which is widely dispersed, some species being found in Australasia, India, Africa, the South of Europe, &c. The genus Parnopes *Latr.* is remarkable for having the maxillæ and labium greatly elongated, forming a long and slender tongue (*fig.* 79. 14.), applied beneath the breast ; and the maxillary and labial palpi are nearly obsolete and 2-jointed. Latreille (*Annales du Muséum*, tom. xiv., and *Bulletin Soc. Philomat.* 1811.) and Saint Fargeau (*Encycl. Méth.* tom. x. p. 8. and 497.) have detailed the economy of this genus, the type of which is found in France, and which deposits its eggs in the nests of Bembex rostrata. According to the more recent observations of the last named author, the female Parnopes enters backwards into the nest of the Bembex (thus evi-

dently showing its object to be to deposit its eggs therein). It is probable that it only then deposits a single egg, as generally a single larva of the Parnopes is only found, and which is engaged at the beginning of the spring in sucking the larva of the Bembex, upon the back of which it has fastened itself.

These insects are extremely interesting in regard to their relations with the other tribes of Hymenopterous insects, being, as Latreille observes (*Consid. Génér.* p. 76.), "sur les confins des deux sections" [Terebrantia and Aculeata]. Mr. MacLeay considered them as allied to some splendid parasitic and exotic bees (*Horæ Entomol.* part 2, p. 429.); and hence Mr. Stephens arranged them after the bees, succeeded by the Chalcididæ, &c. which are supposed to be most nearly allied to the Strepsiptera; and Mr. Curtis (*Brit. Ent.* fo. 724. Jan. 1839) considers that Cleptes, in the minute size of the labrum, forms the link between this family and such species of Chalcididæ [still misnamed Cynipidæ by Curtis] as have the labrum distinct, although small; (Chalcis [Smiera] and Perilampus); and he further states that he has lately received a most remarkable metallic bee from America, which will prove, he expects, that there exists a strong affinity between the Andrenidæ and Chrysididæ.

It is not indeed improbable that a close relation may exist between these insects and some of the parasitic bees; and indeed Parnopes, in the structure of its maxillæ and labium (*fig.* 79. 14.), and almost obsolete palpi, seems to confirm this; but I agree with Latreille in thinking Cleptes allied to Bethylus, and with Shuckard in considering them as related to Tiphia, Meria, &c.: indeed, the Epyris aurichalcea of Klug's MSS. from Cuba, and E. Carcelii *Westw.*, a remarkable insect in the collection of M. Serville, brought from Palestine by the late M. Carcel, evidently confirm this relation.

The second general section of the Hymenoptera, corresponding with the ACULEATA of Latreille, the H. Ovitithers of St. Fargeau, and H. Monotrocha of Hartig, is distinguished by the females (and neuters* of such species as live in society) having the organ of oviposi-

* It is now generally admitted that these neuters (as they have been miscalled), both amongst the bees, wasps, and ants, are individuals of the female sex, which, from the peculiar manner in which they are nourished, become abortive, and acquire habits totally dissimilar from those of the true females. This has long been known to be the case with the bees; the neuters possessing the power, when deprived of their female (or queen), of transforming a larva into a queen, which, under ordinary circumstances, would have produced a neuter bee, or worker; and Huber, the

tion converted into a sting, connected with poisonous glands; composed of a slender horny acute dart, channelled beneath, and inclosing two spiculæ, which are retro-serrated at the tips, and connected at the base with a poison bag* in both females and neuters, and also with the ovaries in the females. This organ is defended, when at rest, by a pair of lateral plates, articulated in the centre, and forming together a kind of scabbard, or sheath, as in the Terebrantia. My *fig.* 79. 15—20. represent the details of the sting of the common wasp. *Fig.* 15. exhibits the terminal segments of the abdomen laid open, and exhibiting the sting *in situ*; s p is the terminal spiracle of the abdomen; b, the basal, and b b, the terminal parts of the lateral sheaths of the sting; c being the sting itself, and *c* the basal muscles of the spiculæ; the dotted part of this figure shows the action of the sting,

admirable historian of the ants, has confirmed this, having observed an occasional sexual intercourse between the males and workers, which was, however, followed by the death of the latter, their organisation not allowing them ordinarily to bring forth eggs: although in certain cases the workers have even been recorded to produce male eggs, the instinct of the males having thus proved them to be of the opposite sex. It is only amongst the social tribes that these imperfectly developed females are found; and when we consider first, the necessity which exists for the performance of the multitudinous labours of the community; and second, the immense numerical excess of these neuters over the females (which latter it will be remembered are merely normally perfect animals), we cannot but be struck with surprise at the remarkable instinct evinced by these insects, which compels them by an artificial process to render the greatest part of the community abortive. It is true that the neuters, which are for the most part the feeders of the society, are not the parents of the objects of their charge; whence we might at first entertain the notion that they cannot possess the sense of philoprogenitiveness in its full extent; but their laborious assiduity in support of the community, together with other circumstances, contradicts such a supposition.

* This poisonous secretion emitted by the sting is soluble in water, but not in alcohol, and separable from the former in the state of white powder; and, when the latter is added, giving a slight red tinge to paper stained with vegetable blue (Kirby and Spence, vol. iv. p. 139.); and Dr. Bevan states, that, if a humble-bee be made to sting litmus paper, the colour is changed to a bright red. Hence, Fontana (*On Poisons*, vol. i. p. 265.) considers that it is mixed in a very small degree with an acid, and not with an alkali: so that spirit of hartshorn is one of the most effectual remedies against the stings of these insects. Its effects are produced when introduced into a wound made by a needle, thus proving that it is not the sting itself which causes the pain. If a bee be made to strike a piece of glass with its sting, and leave a drop of poison, the latter, under the microscope, gradually produces oblong pointed crystals. (Bevan, *Honey Bee*, 2d ed. p. 331.; and see also Blot, in *Mém. Soc. Linn. de Calvados*, vol. i. in which, the nature of the poison and its effects in the different families is treated upon in detail.)

detached from its sheath. *Fig.* 16. represents the same parts, but seen from beneath. *Fig.* 17. exhibits the sting detached, including the two spiculæ *in situ*. *Fig.* 18. is the sting, or rather the channelled dart, grooved beneath for the reception of (*figs.* 19. and 20.) the two spiculæ, separated from the dart, and retro-serrated at the tip. The lettering of these parts being the same throughout, and corresponding with the letters explaining the figures of the same parts in the preceding families, will clearly show the analogies between the sting and the ovipositor. Latreille (*Gen. Cr.* tom. iv. p. 51.) and St. Fargeau (*Hist. Nat. Hym.* p. 80.) expressly state that the eggs are not excluded by the sting, and that this organ is only composed of two setæ, one being inclosed in the other; had they, however, consulted Swammerdam's 18th and 19th plates, they would have perceived that, in both these respects, they had fallen into error. Indeed, when it is remembered that the ovipositor or terebra is but the external outlet of the ovaries and oviduct in the preceding tribes, and that the analogies between it and the true sting are unquestionable, as now illustrated in my various figures, we are, as it seems to me, warranted in considering that the eggs do pass through the sting in the act of oviposition; and this, indeed, is expressly asserted by Dr. Bevan (*Honey Bee*, p. 319. 2d edit.). Hence the account given of this operation by St. Fargeau (*Hist. Nat.* p. 90.), and considered by him as the chief ground for the primary division of the Hymenoptera, cannot be correct. "La ponte n'a point d'organe extérieur et visible; l'anus de la femelle est susceptible de s'ouvrir largement; lors de cette ouverture, il laisse apercevoir un large cavité, au fond de laquelle est un orifice, qui est celui de l'oviducte. L'œuf sorti de l'oviducte par cet orifice, tombe dans la cavité anale (figurée par Réaumur, tom. v. pl. 29. f. 1.); et celle-ci s'ouvrant, le laisse glisser le plus souvent à la place," &c. It appears to me that the whole account here given of this operation is gratuitous. The orifice at the bottom of the anal cavity, considered as that of the oviduct, has, as far as I can ascertain, no existence but in the theory of St. Fargeau. I can find no notice taken of it by Swammerdam and Réaumur; indeed, the latter copies the figure given by the former of the internal organs of the female.

The antennæ are almost invariably simple, and, with very few exceptions, are formed of thirteen joints in the males (*fig.* 81. 13, 14.), and twelve in the females (*fig.* 81. 8.); the palpi are filiform, the maxillary having ordinarily six, and the labial four, joints; but these numbers vary in the tribes of bees and ants. All the wings are veined,

and exhibit several perfect cells. The abdomen, united to the thorax by a longer or shorter peduncle, is composed of seven joints in the males (*fig.* 81. 10.), and six in the females (*fig.* 81. 1.).

These insects are generally of a moderate or large size. The larvæ have no legs, and are subvermiform, or grub-like, in their form. In the fossorial families, and in some of the wasps, they are nourished in cells prepared by the parents, in wood, sand, earth, &c.; and feed upon larvæ or perfect insects, stored up for their support by the females. In the ants, the larvæ are kept in masses, not being inclosed in separate cells, but in a large and general nest, and fed by workers with the juices of fruits, vegetables, animals, &c. In the typical wasps, they are arranged singly in cells, in beautifully constructed combs, being fed with animal or vegetable juices by the females or workers from time to time. In the solitary bees, the food consists of a supply of pollen paste, laid up by the parent insect in the solitary cell in which the larva resides; and in the social bees, the larvæ are, as in the wasps, inclosed in separate cells in regular combs, and are fed by the workers with honey.

With respect to the general economy of the Aculeata, two groups exist; namely, 1. those species which live in society, having individuals of the neuter sex; and 2. those which are solitary in their habits, and consist only of males and females. This is surely a far more natural distribution than that primarily employed by Saint Fargeau, from the nature of the food, namely Phytiphages and Zoophages (*vide antè*, p. 36.). When, however, we consider that many bees and wasps are solitary nest-makers, and many others parasites, and that all these are unprovided with neuters, there is reason to doubt the propriety of the adoption of such a principle of distribution, and to believe, on the other hand, that an arrangement founded upon the general structure of the different groups is the most satisfactory: and Latreille, having proposed several modes of distribution of this section, founded upon such structural considerations, I have not hesitated to adopt this principle, and have accordingly employed the arrangement proposed in his most valuable work, the *Genera Crustaceorum, &c.;* in which he divides it into two subsections: 1. the Prædones, or sand-wasps, ants and wasps, including the families Sphegimæ, Crabronites, Bembecides, Scolietæ, Mutillariæ, Formicariæ, Vespareæ, and Masarides; and 2. the Anthophila, or bees, comprising the Andrenetæ and Apiariæ. In the *Règne Animal*, he has raised the For-

micariæ and Mutillariæ into a third subsection, named Heterogyna (from the apterous condition of some of the individuals), placed at the head of the section; and the Vespidæ into a fourth, named Diploptera (from the folded fore wings), immediately preceding the bees. With Mr. MacLeay, I can, however, scarcely think the folding of the wings in the wasps to be a character of sufficient importance to warrant the establishment of a distinct subsection equivalent with the others.

The subsection Prædones has been divided by Latreille into three groups: namely, 1. the Fossores *Latr.*; 2. the Heterogyna (including the Mutillidæ and Formicidæ); and 3. the Diploptera, or wasps. The term Fossores, employed for the first group, is not, however, sufficiently precise, since many of the bees and wasps are equally fossorial. I would, therefore, propose in its stead that of Insectivora, as all the species feed in the larva state upon other insects. The Heterogyna ought to be restricted to the ants; the apterous condition of the female Mutillidæ, which are in all respects Fossores, not being sufficient to warrant their introduction in the same group as the ants; for which, as the females are winged, it will be necessary to employ another name. I therefore divide the Prædones into the three following groups:

1. Insectivora. Fore wings not folded. Larvæ solitary, feeding on other insects. (Linn. gen. Sphex and Mutilla.)
2. Sodales. Fore wings not folded. Larvæ social. (Linn. gen. Formica.)
3. Diploptera. Fore wings folded. Larvæ, in the social species, separately enclosed in cells. (Linn. gen. Vespa.)

The natural arrangement of these groups is, however, very difficult. Latreille, in his late works, has placed Formica at the head of the Aculeata, with which is arranged Mutilla, followed by the Fossores; commencing the latter with the Scoliidæ, and terminating with the Crabronidæ, passing by some of the latter (as Cerceris) and the unfolded-winged wasp-genus Ceramius *Kl.*, to the solitary wasps. In his *Genera Crustaceorum, &c.*, he, however, placed the ants, wasps, and bees in juxtaposition; a step which appears to me to be so advantageous that I have adopted it in the following pages.*

* The consideration that the *Neuropterous* Termitidæ agree in so many particulars with these *Hymenopterous* groups, is a strong argument against the adoption of the

The first of these three groups, INSECTIVORA*, or the FOSSORES *Latr.*, comprises the different families of sand and wood wasps, and corresponds for the most part with the Linnæan genera Sphex and Mutilla, distinguished by having the wings generally developed in both sexes (some of the Mutillidæ excepted), without the existence of individuals of the neuter sex, and which consequently are solitary in their habits. The legs are formed for walking and burrowing only, and are not fitted for collecting pollen, the basal joint of the posterior tarsi not being enlarged; the wings are never folded, the tongue is never thread-like nor lance-shaped, and the body is not clothed with hairs fitted for the transport of pollen.

In general the females excavate cells in the ground, or in posts, &c., in which they deposit, together with their eggs, various larvæ or perfect insects, and sometimes spiders (according to the species), which are destined for the support of their progeny when hatched. Occasionally the insects composing this store are first stung to death, and then buried: but sometimes they are only slightly stung, so that they continue half-alive, to be killed by the larvæ when hatched. These larvæ are white worm-like grubs, destitute of legs, which would be an incumbrance to them in their narrow cells. When full grown

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Dahlbom. Exercitationes Hymenopterologicæ.

Rossi, Christius, Jurine, Perty, Spinola, Panzer, Savigny (Egypt), *Saint Fargeau* (Enc. Méth.).

" habitudes morales " of these tribes, as of primary importance in effecting their distribution (proved by the identical method of forming their cells). Some of the latter (Odyneri) are so closely allied to the sand wasps, that they might with even greater propriety be termed folded-winged Insectivorous Prædones than solitary Diploptera. The economy of the social ants, on the other hand, notwithstanding their sociality, is so different from that of the social wasps, that it may, perhaps, be ultimately questioned, whether it would not be more natural to adopt a classification, founded upon the affinity of the sand wasps and solitary wasps; placing the Scoliidæ and Mutillidæ at the head of the former, rather than break this affinity by placing the ants between them.

they spin a cocoon, in which they pass the pupa state. The perfect insects are generally very active, and fond of the nectar of flowers, especially those of the Umbelliferæ. They delight in the hottest sunshine, flying and running over sand banks exposed to the mid-day sun, and keeping their wings in continual agitation; their sting is exceedingly powerful, and in the large exotic species a wound from it must be attended with dangerous results.

We are indebted to Saint Fargeau for the notice of an interesting peculiarity in the structure of these insects, indicative, to a certain extent, of their economy, which he has described in the *Encyclopédie Méthodique* (tom. x.), in a memoir upon the genus Macromeris, in Guérin's *Mag. de Zoologie*, and in others upon Gorytes and Crabro, in the *Annales de la Soc. Ent. de France*. Having observed that the species which form their own nests are distinguished by having the anterior legs, and especially the tarsi, furnished with strong spines, and the posterior tibiæ denticulated or spined, he correctly considered the former of these characters as serving for burrowing, and the latter for carrying the prey; and he was thence induced to regard those species which have no spines or ciliæ on the anterior and posterior legs, as incapable of burrowing and provisioning a nest, and consequently as parasites, depositing their eggs in the nests already provisioned by other burrowing Hymenoptera.* It does not, however, appear to have been yet observed at what particular period (with reference to the real inhabitant of the cell) the parasite is hatched; nor whether it merely contents itself with feeding, cuckoo-like, upon the food destined for the supply of its fosterer, which is thus starved to death; or whether, on the contrary, it devours the latter, although, perhaps, it is most natural to suppose that it would do both. An entomologist of our country, who has studied the fossorial Hymenoptera in the true spirit of scientific inquiry — W. E. Shuckard —

* St. Fargeau (*Hist. Nat. Hym.* p. 6.) draws a very proper distinction between those parasites which, like the cuckoo, realise the true sense of the word parasite, and those which prey upon or in the bodies of other insects, as the Ichneumonidæ, &c. which are often also called parasites. St. Fargeau proposes to call them "Carnassiers." This term does not, however, sufficiently indicate them as living within the intestines of the victim, upon which they are exercising their cannibal propensities. Latreille had indicated this diversity by calling a tribe of parasite bees Cucullinæ; but, as St. Fargeau observes, the term parasite is the proper name for such species, sanctioned by well-known and immemorial use. The Ichneumonidæ have been called "Cuckoo-flies" by some English writers, (and in p. 82. I have adopted this expression), but it is not sufficiently precise.

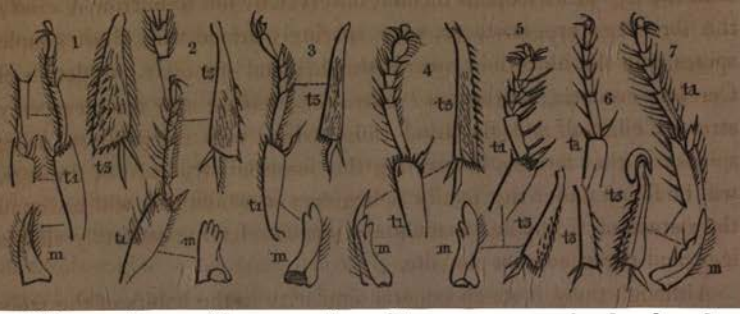
has disproved a portion of St. Fargeau's theory, by observing, that although the sand burrowers have spined legs, others which are destitute of spines burrow in wood.* (*Trans. Ent. Soc.* vol. i.) The reason for this appears to me obvious: the sand burrowers have need of powerful brushes to enable them to make their way through the fine loose particles of sand, whilst the wood burrowers must have recourse to their strong, broad, and multidentate mandibles.† Mr. Shuckard has further objected to the supposed use of the spines of the hind legs for carrying the prey, regarding them as applicable to the formation of the cells, or for the closing of its mouth; in support of which latter opinion he has given an instance in which he had captured one of these insects with the hind tibiæ thickly coated with clay. It is to be observed, however, that in those Aculeate Hymenoptera whose proceedings have been observed, the materials for closing the cells are carried by the jaws. I have also published a memoir still further limiting the theory of Messrs. St. Fargeau and Shuckard (in the *Annales Soc. Ent. de France* for 1836), having observed the rare British species Miscophus bicolor at Coombe Wood, and a species of Pompilus on the Drachenfels, both of which are destitute of spines on the fore legs ‡, in the act of burrowing in the sand; and having further noticed a female of Pompilus petiolatus, which has simple fore legs, engaged in carrying her prey by the help of her jaws and fore legs, and not by the help of the hind legs. Cerceris læta, on the other hand (whose proceedings I have described in the *Trans. Ent. Soc.* vol. i. p. 203.), although furnished with strong posterior tibial denticulations, carries its prey with its four fore-legs, the hind legs alone being extended.

* St Fargeau himself appears indeed to have been aware of the limitation necessary to be thus imposed on his theory, for in his memoir on Crabro he speaks of the presence or absence of spines on the anterior tarsi, indicating that these insects "travaillent dans la terre ou dans la bois." (*Ann. Soc. France*, 1834, p. 692.)

† The variation in the form of the mandibles is not, however, conclusive as to the differences in economy; for in several of the Crabronidæ, which are distinctly wood-borers, the mandibles, as observed by Mr. Shuckard, "are merely bidentate at their apex. May not this disparity arise from the different nature of the wood they are instinctively led to form their nests in? for I have always found that the insects with this shaped mandible make their cells in subputrescent and soft woods, chiefly decaying willows." (*Essay Foss. Hym.* p. 12.)

‡ The theory of St. Fargeau ought moreover to apply to the solitary wasps, Odyneri, &c., which are truly fossorial, as well as to the Fossores; and yet the females of Odynerus have simple tarsi, but are not parasites, provisioning their own nests. (See my notice of the habits of Odynerus Antilope, *Trans. Ent. Soc.* vol. i. p. 78.)

Fig. 80.



With a view to illustrate this subject more completely than has hitherto been done, I have given in *fig.* 80. a series of illustrations of the structure of the anterior and posterior legs of various species, whose economy has been discovered, and which it will be seen vary very considerably *inter se*, so as to have led Saint Fargeau to adopt the theory above noticed. I have also added figures of the mandibles of the different species in question, although the precise share which these organs take in the economy of the several insects has not been clearly noticed: the figures marked t 1 represent the anterior tibia and tarsus, t 3 the posterior tibia, and m the mandible *Fig.* 80. 1. represents these details in Crabro cephalotes ♀, a *wood-boring* species; and in which the anterior tarsi are but very slightly armed with short thin spines: the hind tibiæ are very strong and rough, with short thick spines. *Fig.* 80. 2. represents the same parts in Pemphredon unicolor, also a *wood boring* species, having the anterior tarsi very slightly spined, but furnished on one side with long curved hairs; the hind tibiæ have only four minute spines on the margin. *Fig.* 80. 3. are from Gorytes mystaceus; the fore legs being still less spined, and the hind tibiæ quite simple. This species I have selected, as being that which led Saint Fargeau to establish his theory, considering it a parasite. It is, however, as Mr. Shuckard and myself have discovered, a predatory species; and that gentleman states that he has seen it enter a *sand* bank with its prey. Mellinus arvensis (*fig.* 80. 4.) has stronger and longer spines to the fore tarsi, and the hind tibia has a marginal row of short spines. This is common in *sandy* districts, its prey consisting of Diptera; but it has not been observed to burrow, unless indeed Réaumur's figure, subsequently noticed, be intended for it. *Fig.* 80. 5. represents a more decidedly fossorial

species, Gorytes 4-fasciatus *Fab.*, at least judging from the armature of the legs; but its economy has not been observed. *Fig.* 80. 6. exhibit the legs of Miscophus bicolor, observed by me to burrow in *sand;* the fore legs are, however, very sparingly armed with short simple spines, and the hind tibiæ nearly simple; and *fig.* 80. 7. are details of Cerceris arenaria, a true *sand* burrower; having the fore legs very strongly ciliated, and the hind tibiæ armed with many short strong spines. Other figures, illustrating the fossorial structure of the legs, will be found under the family Sphegidæ; in which also will be found the details of Ceropales maculata, a species having perfectly simple legs, and regarded as a parasite.

Although there is much general similarity in the habits of the truly fossorial species, there is considerrble diversity in the details of their proceedings: thus, whilst Oxybelus conveys its prey by means of its hind legs, Pompilus and Ammophila walk backwards, dragging it with their mandibles. "Astata, Tachytes, Psen, Crabro, Mellinus, and Cerceris, fly bodily and directly forward with it in their mandibles, assisted by their fore-legs." (Shuckard, l. c.) From my own observations, each species appears ordinarily to confine itself to its own particular prey. Instances are on record, however, in which considerable diversity in the prey of the same species has been observed: this probably arose from the female not being able to discover her legitimate prey; thus Serville and Saint Fargeau state that Bembex rostrata indifferently collects the species of Eristalis, Stratiomys, and the larger Muscidæ; but it may be regarded as the ordinary rule, that each species confines itself to its peculiar prey: thus, numbers of the *same* species of fly or larva are found in the *same* cell, although this must sometimes be a matter of difficulty; as, in the case recorded by Réaumur (tom. vi. p. 272.), where numbers of individuals of a species of Anthrax, "plus rares qu'aucune des [mouches] précédentes," were found "dans d'autres trous;" and in other cases mentioned to me by the Senator Van Heyden, of Frankfort, and M. Audouin, in which numbers of the very rare Ogcodes gibbosus had been thus stored up by one of these insects for its young.* The prey is, moreover, very various, comprising insects of nearly every order; the Coleoptera†,

* Réaumur also figures (tom. vi. pl. 27.) cells separately filled with numbers of specimens of a Chironomus? Tetanocera? and Thereva?

† Mr. Shuckard states that he knows only one instance in which a Coleopterous insect is subject to the attacks of these Fossores; namely, Strophosomus, one of the Curculionidæ, preyed upon by Cerceris arenaria. Lixus Ascanii, and several other Curculionidæ, are preyed upon by several other species of Cerceris. (See *infrà.*)

Hemiptera, Homoptera, Lepidoptera, Hymenoptera, Diptera, and spiders, contributing to the support of this tribe: and insects in the larva, pupa, and imago states are employed for this purpose. The number of individuals enclosed in each cell varies according to the size of the species, and of the progeny for whose support it is buried: thus, whilst Ammophila subulosa buries a single Lepidopterous larva, as many as fifty or sixty Aphides are shut up in a single cell by other species.

The Insectivora or Fossores are divisible into the six following families: 1. or 9. Crabronidæ; 2. or 10. Larridæ; 3. or 11. Bembecidæ; 4. or 12. Sphegidæ; 5. or 13. Scoliidæ; and 6. or 14. Mutillidæ. The latter family, although placed by Latreille with the ants in his section Heterogyna, naturally enters the same group as Scolia, Tiphia, &c.; the female Mutillæ being evidently apterous Fossores, rather than solitary ants: indeed, the supposed males of one of the Mutillideous genera Methoca have until very recently been regarded as a distinct genus belonging to the Scoliidæ. In some of the works of Latreille three other families are added, namely, the Nyssonii, separated from the Crabronidæ, the Pompilidæ from the Sphegidæ, and the Sapygidæ from the Scoliidæ. In regarding them merely as subfamilies, I adopt the views of Latreille's Genera Crustaceorum, &c.

The family CRABRONIDÆ* *Leach*, with which I also unite the Nyssonidæ *Leach*, have the head generally large (*fig.* 81. 1. Crabro

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* BIBLIOGR. REFER. TO THE CRABRONIDÆ.

Scheven, in Der Naturforscher. St. 20 (palmated species of Crabro.)

Lepelletier de Saint Fargeau. Mém. g. Gorytes, in Ann. Soc. Ent. de France, tom. i. — Ditto, together with M. Brullé, Monogr. g. Crabro, in Ann. Soc. Ent. de France, 1834.

Latreille. Note of Habits of Philanthus apivorus. Bull. Soc. Philomat. tom. ii., 1799, and in the Hist. Nat. Fourmis.

Thunberg. Note on Trypoxylon figulus in Vetensk. Acad. nya Handl., 1808. — Ditto, Monographia Philanthi, Nov. Act. Upsal, vol. vii.

Brullé, in Ann. Soc. Ent. de France, tom. ii., 1833 (n. g. Nephridia.)

Shuckard, in Trans. Ent. Soc. vol. i. and ii. (*ut suprà.*)

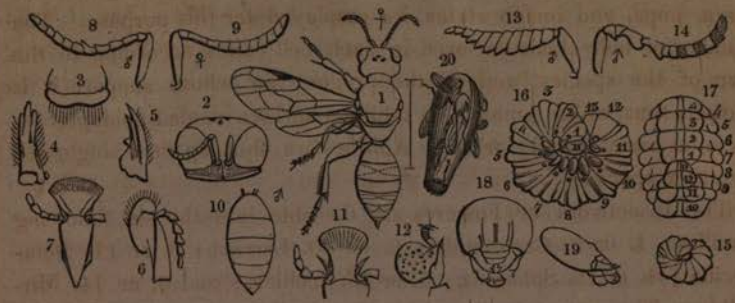
Schäffer. (Crabro cribrarius) Abhandl. von Insect. No. 11.

Schreber, in Der Naturforscher, 15 St. and 20 St.

Kettel, in Isis, 1828 (Crabro parisinus.)

Fabricius, Spinola, Panzer, Jurine, Rossi, Brullé (Morea), *Savigny*, (Egypte).

Fig. 81.



vagus; 2—10. details of ditto, 2. the head seen in front), and nearly square when viewed from above, and sometimes broader than the thorax; the upper lip is generally transverse, small, and but slightly prominent (*fig.* 81. 3.); the mandibles have the outer margin but slightly curved, and not with a deep incision on the outside near the base, as in the Larridæ: they are narrow, and vary in the number of their terminal teeth (*fig.* 81. 4. 5.), being sometimes entire; the maxillæ (*fig.* 81. 6.) and labium (*fig.* 81. 7.) do not unite to form an elongated snout; the antennæ (*fig.* 81. 8. ♀ 9. ♂; 13. ♂ ditto of Crabro cribrarius, 14. ♀ Crabro tibialis) are straight, or somewhat elbowed, often gradually incrassated, the joints being short and closely united together. The collar is less elevated than the mesothorax, and very short, its sides not extending to the base of the wings. The legs are of moderate length; the anterior tibiæ have a dilated spur, pectinated on the inside; and the basal joint of the fore tarsi has a corresponding notch, which is ciliated. The abdomen is of variable form, being in some species attached to the thorax by means of a long peduncle. The number of the submarginal cells varies from one to four.

This family is of considerable extent, and comprises insects of moderate size, often closely resembling wasps in their appearance and colouring, and of great activity; they are especially fond of settling on the broad leaves of plants exposed to the sun.

This family may be divided into two subfamilies, the Crabronides and Nyssonides. In the former the head is large and square; the antennæ often thickened at the tips; the abdomen either oval or elliptic, being largest in the centre, but sometimes it is clavate, the base being

narrowed into a peduncle. In the early works of Latreille, some of the genera arranged in this subfamily in the generic synopsis were placed with the Nyssonidæ and Larridæ; the chief difference between the two families, given in the *Considérations Générales*, being the large size of the head in the Crabronides. In thus uniting them with the other Crabronides, I follow the arrangement of the *Règne Animal*.

The species of this family are varied in their economy, the same genus occasionally comprising species which are apparently parasites, as well as others which form their own nests; at least if we regard the armature of the legs as indicative of these habits. Such, for instance, is the case in the typical genus Crabro, which St. Fargeau has separated into eleven genera, founded primarily upon the presence or absence of ciliæ in the fore-legs of the females. Other characters have also been selected, which certainly appear too trivial, even in some cases separating the sexes of the same insect, as suggested by Mr. Shuckard (*Essay*, p. 121. and 142.). This genus comprises some singular modifications of form, especially in the males, some of which have only 12 joints in the antennæ (*fig.* 81. 9.), offering a remarkable exception to the characters of the Aculeate division. St. Fargeau is evidently correct in regarding these individuals as males with anomalous antennæ rather than as females with 7-jointed abdomens (*fig.* 81. 10.), as they were considered by Vander Linden. Crabro lapidarius, fossorius *L.*, vagus *Linn.* (*fig.* 81. 1.), and others forming St. Fargeau's genus Solenius, exhibit this peculiarity, several of the joints being notched beneath in the males, as well as C. Philanthoides *Panz.* (subterraneus *Fab.*), C. alatus *Panz.*, and others forming the genus Ceratocolus *St. F.*, in which they are entire, as they are also in C. (Thyreus *St. F.*) vexillatus *Pz.*, in which the identity of the male sex is proved by the fore-legs. St. Fargeau asserts the same of C. tibialis *Fab.*, *Pz.*; but this is inaccurate, the male antennæ (although very irregular and notched) being decidedly 12-jointed (*fig.* 81. 14., and see my Observations in *Trans. Ent. Soc.* vol. i. p. 204. tab. 22.). Mr. Curtis described the labium as varying considerably in the two sexes, being very short in the females, but as long as the palpi, and subcylindrical in the males. In recent specimens, however, which I have dissected of C. cribrarius and vagus, the labium of the females (*fig.* 81. 7.) is longer than the palpi, dilated at the tip, and furnished on each side at the base with a minute lacinia, at least in the latter (*fig.* 81. 11.). This genus is further remarkable for

having the ocelli in some of the species arranged in a slight curve, and not in a triangle; and the anterior tibiæ in the males of some of the species are singularly dilated into a broad horny plate.* In Crabro tibialis *Pz.*, the basal joint of the anterior tarsi is also furnished with a broad wing-like membrane, overlooked by St. Fargeau and Brullé, who form this insect into the genus Corynopus, incorrectly stating that the anterior tarsi of the males are simple.

The species whose economy has been clearly traced make their cells in wood, boring into palings, posts, willow-stumps, &c. (C. xylurgus *Shk.*). Crabro cephalotes, one of the most ferocious and predatory of the group, has simple anterior tarsi, but the posterior tibiæ are spurred. This species, according to Mr. Shuckard, employs its mandibles in forming a cylindrical cell in decaying trees, passing the particles of wood beneath them, and ejecting them behind by means of the spines with which the posterior tibiæ are armed. C. cribrarius, according to Latreille, provisions its cell with the larvæ of a small Pyralis, which feeds upon the oak (Tortrix chlorana); but Mr. Shuckard states that it, as well as C. patellatus, employ Diptera for this purpose, as is also the case with other species. I have captured C. (Crossocerus *St. F.*) leucostoma, burrowing into rotten wood, and also carrying its prey, which consisted of a specimen of Anthomyia pluvialis *Meig.*†; and I am indebted to Mr. Pickering for specimens of a nest found in rotten wood, covered with the remains of blue-bottle flies, from which I reared Crabro vagus, the larva of which is white and fleshy, with a scaly head bent under the breast, the extremity of the body being also incurved (*fig.* 81. 15. larva of the natural size, 16. ditto magnified, seen from beneath, 17. ditto seen laterally). It is destitute of legs, but the segments are dorsally provided with a transverse elevated ridge,

* In Crabro cribrarius ♂ (*fig.* 81. 12.), this dilatation is covered with small membranous transparent dots, which, as Latreille observes (*Hist. Nat.* xiii. 321.), gives it the appearance of being pierced, as indeed it was supposed to be by Rolander, who thought it was used by the males as a riddle through which the pollen of flowers was passed, the finer particles only serving for the impregnation of the plant! De Geer, however, disproved this notion by figuring the limb correctly. (*Mém.* tom. ii. tab. 28. f. 2, 3.)

† Bouché has described the larva of this species (*Naturgesch. d. Ins.* p. 178.), as well as that of Stigmus (Diodontus minutus *Fab.*). Réaumur's fig. 14. pl. 27. vol. vi. reared from cells filled with flies resembling house flies (fig. 1. k.), is apparently a small yellow-spotted Crabro, it being stated that its fore-wings "ne se plient jamais." In *Insect Architecture* (p. 52.) it is erroneously stated to belong to the wasp-genus Eumenes.

which, doubtless, serves them instead of feet. The clypeus and upper lip are distinct and transverse (*fig.* 81. 18. front of head; 19. ditto sideways); the mandibles horny and tridentate, the maxillæ and labium short, and formed of fleshy lobes soldered together without any palpi; the labium having three minute tubercles, the central one being evidently the organ from which the silken threads are discharged for the formation of the cocoon. Exclusive of the head, the body is composed of thirteen segments, (numbered in my figures from 1 to 13,) the first and second of which are furnished at their posterior lateral margins with a pair of spiracles; and the 4th, 5th, 6th, 7th, 8th, 9th, 10th, and 11th have also a pair of spiracles placed on their anterior margins, so that there are twenty spiracles in the whole. The larvæ, when first I examined them, were enclosed in an oblong-oval case of a thin papyritious appearance, and of a pale reddish brown colour (*fig.* 81. 20.), to the outside of which the remnants of the flies, which had served for the support of the larvæ, were attached. It is proper to state, in consequence of an observation made by Mr. Shuckard in a note to Burmeister's *Manual Transl.*, p. 357., that both sexes of the Crabro were reared by me from larvæ precisely agreeing in the number of their segments. (See *Trans. Ent. Soc.* vol. ii. p. 127.)

M. Walckenaer states that there are three species of small Crabros with the face silvery, which constantly endeavour to enter parasitically into the cells of Halictus, two of which he names C. punctatus and C. crassipes. (*Mém. Halict.* p. 35.)

The genus Trypoxylon *Latr.*, at once distinguished by its reniform eyes (*fig.* 82. 9.) and long abdomen, was considered by Saint Fargeau (*Enc. Méth.* tom. x. p. 749.) as parasitic; and consequently that its name, given to it in allusion to its wood-boring habits, was inapplicable. The Linnæan account of its habits, as observed by Bergman (*Syst. Nat.*, vol. ii. p. 943.), is, however, substantially correct, as I have clearly proved by some facts published in the *Trans. Ent. Soc.* vol. i. p. 205.; although, from having repeatedly seen it enter the burrows of other insects, I was at first induced to adopt the notion of St. Fargeau. Its object, however, I subsequently found was evidently to make use of the holes of other insects commenced in wood-work, by first enlarging and then plastering them with a coating of fine sand. The prey of T. figulus is a small spider, which appears to me to be the young of Epeira diadema. Mr. Kennedy (*Lond. and Ed. Phil. Mag.*, Jan. 1837) also observed it carrying spiders, varying greatly in size, into

holes in posts and straws in a thatch; placing them in cells separated from each other by a double partition of clay; a single egg being placed in each cell, attached to the abdomen of a spider, near the bottom of the cell. Sometimes as many as twelve or more spiders, if small, are placed in one cell. The female makes a buzzing noise when constructing the clay partitions. Trypoxylon clavicerum is similar in its habits, but it does not leave any space between its cells. Mr. Shuckard also mentions that the former had been observed in the act of depositing a small round ball or pellet, containing about fifty individuals of a species of Aphis, in a hole in a post, pre-occupied by an Odynerus; but surely some error must have crept into this statement. (See further on the habits of this genus, Shuckard, *Essay*, p. 116.; St. Fargeau, *Enc. Méth.* tom. x. p. 750.; Curtis, *B. E.* p. 652.; and Thunberg, in *Swedish Trans.* 1808.)

Pemphredon lugubris (P. unicolor *Jur.*), according to Latreille and Shuckard, provisions its nest with Aphides (and see Curtis, fol. 632.). The latter author states that he had never seen it make its own cell, but which he considered very probable, from the structure of its jaws; and Mr. Kennedy states that P. lugubris *Fab.* burrows in decayed wood, and throws out the sawdust, depositing Aphides, which is also the case with P. unicolor *Panzer*. P. minutus, however, is found only upon sand: its anterior tarsi are simple, but the posterior tibiæ are spined. P. insignis is considered by Mr. Shuckard to be a parasite.

Mr. Kennedy has published an account of the habits of Diodontus gracilis and corniger, both of which provide Aphides for the food of their progeny, carrying them in the mouth into cells in the holes of posts. He also discovered the cells of Stigmus troglodytes *V. L.* in hollow straws of a thatch; the cells being filled with minute insects, which appeared to be the larvæ of a Thrips, as many as fifty being found in one cell. St. Fargeau, on account of the structure of the legs, considered this to be a parasitic genus. (*Enc. Méth.* tom. x. p. 493.)

I have observed Mellinus arvensis burrowing in sand banks. Mr. Shuckard says that its prey consists of Diptera*, especially Muscidæ;

* Mr. Curtis attributes to the females of this genus an economy which has not been noticed in any other Fossorial Hymenoptera, namely, that of carrying dead flies to the young larvæ when hatched, for the latter to feed upon. He indeed records the observation, that he had observed a female Mellinus flying about with a large blue fly (probably Musca vomitoria), which it afterwards drew into its burrow, in

and Kirby and Spence state that it selects the smaller flies, including the troublesome Stomoxys calcitrans. (*Introd. to Ent.* vol. i. p. 263.) Panzer, however, records its preying upon an Aphis. I regard Réaumur's figures 13—17. pl. 26. tom. vi. as representing this species; its cells being filled with Dipterous "mouches," its fore wings not being folded, and its abdomen peduncled. In *Insect Architecture* (p. 53.) the cocoon of this insect, copied from Réaumur, is stated to be that of "a *carpenter* wasp, composed of *sawdust* and wings of insects;" but incorrectly, Réaumur expressly stating that its cells were found in the sand (tom. vi. p. 269.).

Gorytes *Latr.* is another genus, comprising species varying considerably *inter se*, in respect to the armature of the legs, whence St. Fargeau has divided them into numerous genera, as in Crabro. The more recent observation, however, in this country, of the habits of some of the species, supposed to be parasites, in consequence of the absence of ciliæ, or spines, is sufficient to prove the impropriety of such a step. In June, 1837, I observed the female of G. mystaceus engaged in protruding her legs and sting into a patch of the frothy secretion caused by the larva of Aphrophora spumaria, without, however, being able to dislodge the occupant. Subsequently I saw it similarly occupied with a drop of water, evidently mistaken for the froth: it then tried another patch of the froth, but unsuccessfully; but I shortly afterwards observed it with a larva of this insect, which it carried beneath its body by the help of its middle legs. Mr. Shuckard has also captured it, as well as his G. Fargeii (G. campestris *St. Farg.*), with a similar prey.

The species of the genus Psen (P. ater *Fab.*), according to Mr. Shuckard, nidificate in sand; whereas those of his genus Mimesa (P. equestris and bicolor) appear to be wood burrowers, and provision their cells with the larvæ of different species of Homopterous insects. Psen atratum has been observed by Mr. Kennedy to make its cells

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spite of its struggling; but I much doubt if the Mellinus had at that time even deposited its eggs. M. Du Hamel also was of opinion, that the females of the insect figured by *Réaumur*, tom. vi. pl. 26. fig. 16. (which I regard as a Mellinus) fed their young daily with flies (*Mém.* tom. vi. p. 269.); but Réaumur gives no assent to such observations. Latreille indeed says (*Hist. Nat. Ins.* tom. xiii. p. 313.), "C'est surtout des mouches que la femelles donnent à leurs petits," but the preceding paragraph proves that they are deposited with the eggs.

in the straw of a thatch *, providing them with Aphides, as many as a hundred of which were found in some of them. The egg is white and semitransparent, and is attached to the abdomen of an Aphis, at the bottom of the cell. (*Lond. and Edinb. Phil. Mag.* Jan. 1837.)

Fig. 82.

The beautiful genus Cerceris *Latr.* is distinguished from all the other British species by the contraction of the segments of the abdomen (*fig.* 82. 7. ♂, 8. ♀.) The males have a long moustache on each side of the clypeus, just above the base of the mandibles, as figured by Savigny in the great work on Egypt; who also represents some species as having the face produced in front into a short nose, and the labium on each side armed at the base with slender paraglossæ. There is considerable diversity in the habits of the species. Walckenaer has given us a minute detail of the economy of C. ornata, which forms its nest in footpaths, and other situations exposed to the sun, to the depth of about five inches, but in a tortuous direction. The provision which this insect lays up in store for its progeny consists of different species of Halictus (H. terebrator *Walck.* and a small green species), which abound in the same situations; three individuals of the former and one of the latter being enclosed, in a half-dead state, for the supply of one larva. (Mr. Shuckard mentions H. rubicundus, fulvo-cinctus, and leucozonius; and Walckenaer adds, that when, at the close of the season, the Halictus terebrator becomes scarce, the Cerceris will take

* Psen? caliginosus? is recorded in the *Entomological Magazine* (No. 21.) to make its cells in straws of a thatch, each straw containing as many as ten or twelve of the larvæ: the statement, however, that in the month of August many of the straws frequented by them were filled with a sweet glutinous substance, seems to contradict the opinion that these insects were the legitimate inhabitants of the straws.

other species.*) The larva is described by the latter as possessing twelve segments, exclusive of the head and an anal tubercle (making fourteen segments in the whole). The head, which the insect moves about in all directions, has two small black tubercles on the lower part of the face, which appear to be eyes, but different from the ocelli of the imago; it is destitute of antennæ: the labrum is separated by a line from the clypeus; the lower lip is elongated, cylindrical, swollen, protruded beneath. [This protruded part, I apprehend, is the true labium and the lateral parts.] The maxillæ [or, rather, the mandibles] are cylindrical; and in the middle they are enclosed between the labium and upper lip. The last segment of the body is terminated by a small and very curious pointed cone. When full grown, it spins an oval and slender cocoon, of a pale colour, thickened at one end, and provided with a small brush of black hair, which is used in fixing the cocoon in the ground. (*Mémoire sur les Abeilles solit. Halicte*, p. 44.)

Other species of the genus provision their nests with species of Curculionidæ. Of these I have published (*Trans. Ent. Soc.* i. p. 203.) an account of the habits of Cerceris arenaria *Linn.* (læta *Fab. Curt.*), which makes its burrow in sand, and provisions it with a species of Strophosomus (one of the Curculionidæ), which during flight it carries by means of its four fore legs, its hind legs being extended. According, however, to the *Entomologische Bemerkungen* (Brunswick, 1790, p. 6.), other short-snouted weevils are employed by this species, such as Pachygaster picipes, raucus, &c. Cerceris aurita, according to Latreille (*Annales du Museum*, tom. xiv., and *Bull. Soc. Philomat.* 1810), employs the destructive Lixus Ascanii and other weevils; and M. Bosc has described two other species of this genus (*Annales d'Agriculture*, tom. lvi. p. 89.), which select other species of the same family. St. Fargeau also states that they have the instinct to capture these beetles at a time when their elytra are soft, from having been but recently disclosed.

M. Walckenaer has also described a cocoon which he discovered in the ground, covered with the débris of multitudes of a species of Chrysis, and which he considered had probably served for the food of the larva of one of these insects.

We are indebted to Latreille for a most interesting account of the economy of Philanthus triangulum *Fab.*, apivorus *Latr.* (published in

* Mr. Curtis states that it is with the dead bodies of the Andrenæ that they provision their nest; but this is incorrect. (*Brit. Ent.* 269.)

his *Hist. Nat. Fourmis*, p. 307.). This species burrows in hot sandy situations, and provisions its nest with hive bees*; a single individual of which after being stung is deposited with an egg; and, as each deposits five or six eggs, the number of bees destroyed must be at least equal to that, if not more considerable, which is most probable; and Latreille counted as many as fifty or sixty females occupied in making their burrows in a space of ground 120 ft. long. The proceedings of this fine species do not materially differ from those of the Cerceris. The mandibles of the larva are described as two "crochets triangulaires plats, courbés, connivents, très durs, bruns, rapprochés à leur base, et recouverts par un avancement, en forme de bec."

I am indebted to M. Perchéron for the cocoon and pupa of this species: the former is ten lines long, flask-shaped, and formed of a single thin pellicle, thickened and black at the narrow end.

The second subfamily Nyssonides (Nyssonidæ *Leach*) have the abdomen of an ovoid-conic or conical form, being broadest at the base, and never attached to the thorax by means of a long peduncle. The head is of moderate size, with the antennæ filiform, the basal joint but slightly elongated, and the mandibles are not strongly notched on the outside at the base.

The species of the typical genus Nysson appear to nidificate in the sand, but their prey has not been observed.

The genus Oxybelus *Latr.* is remarkable for the armature of its thorax, the scutellum (of the mesothorax) is simple, and the metathoracic præscutum is armed at the sides with lobes, and the base of the metathoracic scutellum with a spine (*fig.* 82. 12. 13.) The description given by Curtis, Shuckard, &c., is not sufficiently precise. The common species, O. uniglumis *Linn.* abounds, in the summer, upon the flowers of umbelliferous plants; and Mr. Shuckard states that the female has a peculiar mode of carrying and holding its prey, which consists of Dipterous insects, whilst opening the mouth of its burrow or forming a new one. It is a bustling little creature, and I have observed that it uses its two fore legs in making its hole with the greatest rapidity, moving them alternately, and soon scratching the burrow sufficiently deep to cover itself.

* Mr. Curtis adds, that it most commonly places an Andrena in its cell (*Brit. Ent.* No. 273.); and Mr. Shuckard (*Essay*, p. 248.) says, that it is recorded to prey upon species of the genus Halictus, thus evidently erroneously confounding it with Cerceris ornata.

Astata Latr. affords an example of the confluence of the eyes in the crown of the head in the males (*fig.* 82. 6.). A. boops *Schr.* (A. victor *Curt.*, abdominalis *Panz. Latr.*) is the only British species (*fig.* 82. 1. ♀, 2. labrum, 3. mandible, 4. maxilla, 5. labium). It is exceedingly active, and its flight is very rapid. The males seem to select a spot on the ground, or, more especially, bits of dry horse-dung, on which they sit for a length of time; but, on approaching them, they dart off, making a large circle, and then fly back to the same spot, chasing flies, &c., away, should they approach: when alighted they turn themselves round once or twice, as if to make a complete survey, and then remain still for a time. I have captured it with its prey, which consisted of the pupa of Pentatoma dissimilis?; but Mr. Shuckard states that he always found it to consist of the larva of P. bidens, and that Mr. Curtis took it with the larva P. prasina. Mr. Curtis, however, states that it was the pupa of P. prasina or of P. dissimilis. The former gentleman also states that Mr. Smith had captured it carrying off Epeolus variegatus; and he has also informed me that he caught one carrying a spider, which it had killed with its sting.

The family LARRIDÆ* (*fig.* 82. 14. Larra Ichneumoniformis; 15—18. details of its mouth) is closely allied to the preceding family, but differs in the mandibles (*fig.* 82. 16.) having a deep notch on the outer margin near the base; the labrum (*fig.* 82. 15.) is but slightly exserted, or entirely concealed by the clypeus; the maxillary lobes (*fig.* 82. 17.) are rather large, and the labial laciniæ distinct (*fig.* 82. 18.); the abdomen is either ovoid-conic or conical, broadest at the base, and not annexed to the thorax by means of a peduncle; the collar is small, and does not extend backwards to the base of the wings; the legs are of moderate size, those of the females generally strongly ciliated for burrowing. This family is of small extent, and the species of which it is composed are of small or but moderate size. They are ordinarily found in sandy situations, but the precise eco-

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* BIBLIOGR. REFER. TO THE LARRIDÆ.

Brullé, in Ann. Soc. Ent. de France, tom. ii. (Nephridia.)

Shuckard, Trans. Ent. Soc. vol. ii. (Monogr. Pison.)

The general works of *Fabricius*, *Rossi*, *Spinola*, *Klug* (Symb. Phys.), *Savigny* (Egypte), *Brullé* (Morea), *&c.*

nomy of very few of the species has been hitherto observed. Many of the species of the typical genus Larra *Fab.* exhibit a splendid sericeous coating, and are further distinguished by the two upper ocelli, which are large, and tortuous in their form (Savigny, *Egypt*). The species of the allied genus Tachytes *Panz.* (Lyrops *Illig.*) are generally captured in sand-banks. L. pompiliformis is stated by Mr. Shuckard to provision its nest with the larvæ of a small Lepidopterous insect. The rare British species Miscophus bicolor *Jur.* (hitherto, I believe, taken by no other collector but myself) also frequents sand banks, in which I have observed it burrowing (see *Trans. Ent. Soc.* vol. i. p. 203.), although its legs are almost destitute of spines or ciliæ (*fig.* 80. 6.). The beautiful and equally rare Dinetus pictus *Jur.* is remarkable for the curious convoluted antennæ of the males. The exotic genus Palarus is at once distinguished by the constricted segments of its abdomen. Savigny has figured several very singular allied insects (*Egypte. Hyménopt.* pl. 11.), in one of which the maxillary palpi are quite anomalous (*fig.* 82. 10.), the fifth joint being greatly dilated, and terminated by two large oval masses attached to the joint by a short peduncle. It may possibly be the effect of disease, as a figure of a palpus of the ordinary form (*fig.* 82. 11.) is added by Savigny. The mandibles in this species are very slender and entire, both externally and at the tip.

The family BEMBECIDÆ * (*fig.* 82. 19. Bembex rostrata) is also of small extent, corresponding with the genus Bembex of Fabricius, and chiefly distinguished by the structure of the mouth. The labrum is triangular and exserted; the head is transverse, the eyes extending to its posterior margin; the mandibles are acute, with a tooth on the inside; the maxillæ have the terminal lobe well developed, being greatly elongated in the typical genus (*fig.* 82. 20.); the labium is also elongated, forming in Bembex a very long tongue (*fig.* 82. 21.),

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* BIBLIOGR. REFER. TO THE BEMBECIDÆ.

Dufour, Memoir on Stizus, Annales Soc. Ent. de France, 1838.

Eschscholtz, Entomographien.

The general works of *Fabricius*, *Perty*, *Spinola*, *Say*, *Klug*, *Rossi*, *Savigny* (Egypte), *Brullé* (Morea), *&c.*

with two long lateral laciniæ. The collar is minute, not extending laterally to the base of the wings; the body is elongate, and posteriorly acuminated, smooth, and generally varied with black and yellow; the legs are short, or but of moderate length, and the anterior are generally furnished with strong ciliæ. They are of a moderate size; some few, however, are nearly as large as any known Hymenoptera. They are generally inhabitants of hot climates, and are extremely active in their movements, flying from flower to flower, and making a sharp humming noise; many of them emit a rose-like scent. They appear only in summer.

No species of this family has hitherto been proved to be a decided inhabitant of this country, although Donovan has figured a species of Bembex (B. octo-punctata, *Brit. Ins.* vol. xiv. pl. 474.). The type of this genus is B. rostrata (Apis rostrata *Linn.*), which is an inhabitant of the central and southern parts of Europe. It is about the size of a wasp. This genus is remarkable for having the lower parts of the mouth (the maxillæ and labium) produced into a long trunk or proboscis, like that of the bees. The female burrows in the sand to a considerable depth, burying various species of Diptera (Syrphidæ, Muscidæ, &c.), and depositing her eggs at the same time in company with them, upon which the larvæ when hatched subsist. When a sufficient store has been collected, the parent closes the mouth of the cell with earth. The history of B. rostrata has been detailed by Latreille in the *Annales du Muséum* tom. xiv.; and *Bull. Soc. Philomat.* 1810, 1811; and by Messrs. St. Fargeau and Serville (*Encycl. Méth.* tom. x. p. 497.). According to the latter authors, the Bembex is subject to the parasitic attacks of Parnopes carnea (one of the Chrysididæ), as above described. An anonymous correspondent in the *Entomol. Mag.* (vol. iii. p. 464.) states that B. rostrata constructs its nests in the soft light sea-sand in the Ionian islands, and appears to catch its prey (consisting of such flies as frequent the sand; amongst others, a bottle-green fly) whilst on the wing. He describes the mode in which the female, with astonishing swiftness, scratches its hole with its fore legs like a dog. Bembex tarsata, according to Latreille, provisions its nest with Bombylii.

The genus Stizus appears to form a connecting link between this family and the Scoliidæ, with which latter it agrees in the males being armed with one or three acute points at the extremity of the body; the lower parts of the mouth are not produced into a long

proboscis. M. Léon Dufour has described some peculiarities exhibited in the structure of the intermediate legs and antennæ of the males of this genus (*Ann. Soc. Ent. France*, 1838, p. 276.), as well as the structure and uses of the spines at the extremity of the body of the males. I possess a remarkable species of this genus from the Cape of Good Hope, given to me by Dr. Klug (S. alternans *Kl.* MSS.), in which the base of the abdomen is armed on the under side with a strong curved horn.*

The insects composing the family SPHEGIDÆ† (including the Pompilidæ) are distinguished from the preceding by having the collar laterally dilated and extending as far as the base of the wings; the legs are very long, the posterior pair being often more than twice as long as the head and thorax; the antennæ are filiform or subsetaceous and long, composed of elongated joints, those of the females being often convoluted and scarcely serrated; the body is long, with the abdomen often attached to the thorax by a long peduncle; the labrum is seldom exserted; the mandibles are elongate, curved, narrow, and acute at the tips, and not notched on the outside at the base; the eyes are entire; the legs are in general eminently fossorial,

* The same character exists in a specimen of Bembex monodonta *Say*, sent me by Dr. Harris, of Massachusetts.

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† BIBLIOGR. REFER TO THE SPHEGIDÆ.

Klug, in Neue Schriften der Gesellsch. Nat. freund. zu Berlin, vol. iii. (*Sceliphron*, Ammophila.)

Dahlbom. Monographia Pompilorum Sueciæ Lund. 8vo. 1829. — Ditto, Monographia Sphegidum (et Pompilorum) Sueciæ, in Exercit. Entomol. 1831-32.

Kirby. Ammophila, n. g. Insects in Trans. Linn. Soc. tom. iv. 1798.

Lepelletier, Comte de Saint Fargeau, in Guér. Mag. Zool. Ins. 29, 30. (Macromeris). — Ditto, 33. (Sphex Latreillei). — Ditto, 34. (Sphex Thunbergii.)

Heyer, on Pepsis lutaria, in Germar Mag. der Ent. vol. iv. p. 409.

Haliday, in Trans. Linn. Soc. vol. xvii. (G. Chirodamus.)

Schiodte. Pompilidarum Daniæ Disp. Syst. Havniæ, 1837. 8vo.

Shuckard. Essay Fossores. — Ditto, in Trans. Ent. Soc. vol. ii. p. 72. (Exeirus.)

Fabricius, Klug (Symb. Phys.), *Coquebert, Drury, Savigny* (Egypte), *Shuckard, Rossi, Spinola, Panzer, Perty* (Brazil), *Brullé* (Morea).

the anterior tibiæ and tarsi being strongly ciliated, and the posterior tibiæ spined in the females.

Some of these insects, inhabiting tropical climates, are amongst the largest of Hymenopterous insects, the wings measuring not less than four inches in expanse. They are exceedingly active and very restless in their motions, and may often be seen upon sand-banks, &c. running along with their wings in constant vibration. Their sting is very powerful. They are considerably varied in their colours, and a few of them are splendidly metallic.

Latreille in some of his earlier works divided this family into two, the Sphegides and Pompilides. In his *Genera Crustaceorum*, however, as well as in the second edition of the *Règne Animal*, they constituted but a single family. I therefore regard them as subfamilies.

Fig. 83.

The first subfamily Sphegides has the collar narrowed in front, forming an elevated piece or node; the first segment of the abdomen, as well as occasionally a part of the second, is contracted into an elongated peduncle; the fore wings always exhibit three perfect submarginal cells, and the commencement of a fourth terminal one. Of these insects, Ammophila *Kirby*, and Pelopæus *Fab.* are both remarkably distinguished by the extreme slenderness and length of the abdominal peduncle, which, especially in the latter, is not thicker than a fine pin. The genus Ammophila (*fig.* 83. 1. A. sabulosa ♀; *fig.* 2—13. details of this species), as the generic name imports, was established by Mr. Kirby in an interesting memoir published in *Linn. Soc. Trans.* vol. iv. and is further distinguished by the great elongation of the maxillæ and labrum (*fig.* 83. 2. represents the front of the head; *fig.* 83. 3. the labrum; *fig.* 83. 4. the mandible; *fig.* 83. 5. the maxilla with its apical lobe reflexed; *fig.* 83. 6. the same with the lobe extended; *fig.* 83. 7. the labium, with the ligula partially withdrawn

into the tube of the mentum; *fig.* 83. 8. the same entirely exserted; *fig.* 83. 9. the anterior fossorial tarsus; *fig.* 83. 10. the base of the posterior tarsus with the ciliated tibial spur; *fig.* 83. 11. the abdomen of the female seen sideways, showing that the ventral arc of the first segment is anteriorly transformed into a complete cylinder, forming the first apparent segment of the peduncle). The species inhabit sandy districts, in which A. sabulosa *Linn.* (vulgaris *Kirby*) forms its burrow, using its jaws in burrowing; and when they are loaded, it ascends backwards to the mouth, turns quickly round, flies to about a foot's distance, gives a sudden turn, throwing the sand in a complete shower to about six inches' distance, and again alights at the mouth of its burrow. (Westwood, in *Trans. Ent. Soc.* vol. i. p. 200.)

Latreille states that this species provisions its cells with caterpillars, but Mr. Shuckard states he has observed the female dragging a very large inflated spider up the nearly perpendicular side of a sand-bank, at least twenty feet high, and that whilst burrowing it makes a loud whirring buzz* (*Essay* p. 77.); and in the *Trans. Entomol. Soc.* (vol. i. p. 57.) he states that he had detected both A. sabulosa and hirsuta dragging along large black spiders. Mr. Curtis observed it bury the caterpillars of a Noctua and Geometra. (*Brit. Entomol.* pl. 604.) St. Fargeau, however, states A. sabulosa collects caterpillars of large size, especially those of Noctuæ, with a surprising perseverance, whereas A. arenaria *Fab.* (hirsuta *Scop. K.* and *Shk.*), forming a distinct section in the genus, collects spiders (*Encycl. Méth.* tom. x. p. 452.). Walckenaer also states that A. sabulosa "enterre des chenilles." (*Mém. Halicte*, p. 47.) In the *Trans. Entomol. Soc.* (vol. i. p. 199.) I have published a detailed account of the mode in which A. hirsuta constructs its cell, and which differs in some respects from that of A. sabulosa, and of the manner in which it carries along and buries a large smooth green caterpillar of one of the Noctuidæ. Whilst burrowing, I also observed that it made a loud buzzing noise. It also appeared to me that each burrow was intended only for a single cell; Latreille, however, seems to imply the contrary. (*R. An.* tom. v. p. 322.) It is to the last named species that I refer the very interesting account given by Ray (*Hist. Insect.* p. 254.) of the proceedings of a species of "Vespa Ichneumon," observed by

* M. Goureau also notices the same fact in A. sabulosa, in *Ann. Soc. Ent. France*, 1837, p. 66.

himself and Willughby, and which not only formed its cell in the earth, and buried a green caterpillar therein three times larger than itself, but afterwards carefully closed the hole by rolling in particles of sand and bits of stone. It was also observed to fly to a fir tree, as it seemed, to fetch a supply of resin to agglutinate the sand together, and it ultimately fetched two fir leaves, which it placed over the mouth of the burrow to mark the spot.

The males are exceedingly ardent during their amours, seizing their partners round the neck with their sickle-shaped jaws. I have represented (*fig.* 83. 12.) the cocoon of A. sabulosa, dug out of a sand-bank at Coombe Wood, and presented to me by Mr. Ingpen. The insect had made its escape at the top, gnawing it open irregularly: it is of a white, slender, and papyritious texture, and encloses a second distinct cocoon of a similar nature, but lined with a shining brown substance. Réaumur's pl. 28. fig. 8—11. represent the cocoon and larva of an insect, probably belonging to this family, having been found, "sous terre," with remnants of flies.* But Réaumur seems to have mistaken the head of the larva for the tail (*fig.* 83. 13. in a reversed position).

The Pælopæi are for the most part exotic, and construct their nests in the corners of rooms, &c. consisting of several ranges of numerous cells of fine earth, the entrances to which are from beneath, each cell being surrounded by a spiral layer of earth. Drury, however, figures the nest as consisting of about a dozen cells, enveloped in a general case of mud, which does not exhibit any spiral arrangement, as figured by Réaumur. In each cell the insect places a green caterpillar or spider, which is then closed, according to Palisot de Beauvois; but according to Bonnet, the cells are revisited by the parent fly after the grub has consumed the enclosed food, in order to give it a fresh supply, and which is repeated until it has attained its full growth. Palisot de Beauvois and Drury have given accounts of the proceedings of these insects (*Illust. Ins. Sphex cæmentaria*, tom. i. p. 99., Pelop. lunatus *Fab.*), stating that spiders are deposited in the cells.† (See also Disderi, in *Turin Trans.* vol. iii. (P. spirifex); Réaumur,

* Réaumur states (tom. vi. p. 292.) that this larva "devient une guêpe ichneumon dont le corps tient au corselet par un long fil;" but in a preceding page (278.) he states that his larva had died, and that he regarded it as the larva of such insect upon the authority of Vallisnieri, (vol. i. pl. 3. fol.), where a similar cocoon and imago, answering to this description, had been figured.

† In the nests observed by Mr. Saunders, caterpillars were stored up.

Mém. tom. vi. mém. 8. pl. 28. f. 4—6. representing the nest and imago of a species from St. Domingo.) Such is the account given in various works; but an indefatigable observer, W. W. Saunders, Esq., F.L.S., in a memoir upon the habits of some Indian insects, published in the *Trans. Entomol. Soc.* (vol. i. p. 62.), seems to have satisfactorily proved that the nests in question are constructed by a species of Eumenes, and that the Pelopæi are parasites upon them, having opened several cells constructed by the Eumenes, and found Pelopæus therein.*

In support of this opinion I may observe, 1. that the legs of the female Pelopæi are simple, and unprovided with apparatus for the construction of such nests; and 2. that it is only amongst the bees and wasps that we find the habit of constructing nests with materials brought from a distance.

Some of the exotic species of the restricted genus Sphex are amongst the largest species of Hymenopterous insects. St. Fargeau states that he was not acquainted with the precise food stored up in their nests. An interesting account has, however, been given of the habits of two American species by Latrobe, in the *Trans. Philos. Soc. of Philadelph.*, vol. vi.; one of these is the Sphex cærulea, which, according to Catesby, has been known to drag a spider along eight times its own weight. In the *Philosophical Transactions* for 1749, an account is given by Mr. Bartram of the economy of a yellowish species of Sphex from Pennsylvania, which, (as well as a Sphex? observed by Duhamel, and recorded by Réaumur,) instead of burying spiders or caterpillars, is asserted to supply its young with a periodical provision of living flies.† Another species of Sphex, or perhaps more probably an Ammophila, from Pennsylvania, buries two or three large green grasshoppers for the food of its posterity, which it stings in such a manner that they remain half alive till the larva is hatched. (See also Carpenter, in *Gill's Technol. Repos.* 1829.) The beautiful East Indian and Mauritian species Ampulex? (*Jur.* Chlorion *Latr.*) compressum *Fabr.*, according to Sonnerat (*Voyage aux Indes Orient.*) and Réaumur (*Mém.* tom. vi. p. 280.), provisions its nest with Blattæ,

* Drury figures the cocoon of the Pelopæus found in the cells, agreeing with that of Ammophila, so that there can be no doubt that the Pelopæus is reared therein.

† Here, as in the observations upon Mellinus and Pelopæus, I can but observe, that the fact of a periodical feeding of the larvæ by the parent fly is problematical. I believe this is done by none but *social* insects.

which it first stings to death. The account of the proceedings of this species was communicated to the latter by M. Cossigni, who had observed it in the Isle of Bourbon.

The second subfamily Pompilides has the collar either transversely or longitudinally square, with the abdomen more or less oval, and attached to the thorax by a very short peduncle. The legs are very long. The fore wings have two or three perfect submarginal cells, and another commenced at the tip of the wings. The maxillary palpi are more robust than in Ammophila (*fig.* 83. 17.), and the labial lobes much shorter (*fig.* 83. 18. Pompilus). These sand-wasps are amongst the most ferocious of the insect tribes, and some of the large exotic species of Pepsis are the largest of known Hymenoptera; many of them have their wings black, or varied, and shining with the most brilliant metallic tints. The species of the British genus Pompilus are exceedingly active, running amongst grass, &c. in hot sandy situations with great agility, and with their wings in constant agitation: their long legs give them much the appearance of spiders; and, indeed, some of the species provision their cells (which they burrow in the sand) with these insects, which they first sting to death. P. niger, however, attacks a small Lepidopterous larva. (Shuckard, *Essay*, p. 52.) Some of the species of this genus have the legs unarmed, as P. bifasciatus and petiolatus: these Mr. Shuckard considers to nidificate in wood (*Trans. Ent. Soc.* vol. i. p. 56.); although, never having observed any species with these habits, he considers it would necessarily be such as are without the ciliation of the tarsi. St. Fargeau also states that *some* species make their nests in burrows, which they discover already formed in wood, without, however, naming such species. We have already seen that the absence of ciliæ does not necessarily indicate wood burrowing habits, according to Mr. Shuckard's theory, neither does it indicate parasitic habits in these insects, according to St. Fargeau's, as I have proved by observing the proceedings of P. petiolatus in the act of carrying its prey, which consisted of a large dead spider *; and of a species allied to P. petiolatus, which I captured in the act of burrowing in the sand of the Drachenfels, although furnished with simple tarsi. (Westwood, in *Ann. Soc. Ent. de France*, 1836, p. 300.)

* I have more recently observed P. petiolatus in the act of forming its cell in the chinks of the walls of my residence at Hammersmith. It employs a particular kind of clayey soil, which it carefully selects for this purpose.

Another species (P. fuscus), whose proceedings I observed at Coombe, is most persevering and undaunted in its endeavours to carry its prey to its place of destination. This consisted of a large dead ant, which it endeavoured to drag up a perpendicular bank, and ultimately succeeded after many falls. The armature of the fore and hind legs, as first noticed by Van der Linden (*Obs. Hym. Fouiss.* vol. i. p. 35.), affords good characters for the division of this genus into minor groups, and has been employed by Schiodte to separate the Danish species into five genera (as indicated in my generic synopsis), including Ceropales (*fig.* 83. 14. C. maculata ♀, *fig.* 83. 15. anterior tarsus ♀, *fig.* 83. 16. posterior tibia ♀), which has perfectly simple legs, and which St. Fargeau regards, with apparent justice, as a parasite, having often observed the females of this genus enter backwards into the nests of some of the real fossorial species, which he considered a certain proof that their object was to deposit their own eggs therein. (*Enc. Méth.* tom. x. p. 183.) In some unpublished drawings of Abbott, the Georgian entomologist, I have observed representations of the attacks of a species of Pompilus upon a spider.

Amongst the exotic genera of this family may especially be mentioned Trigonopsis *Perty*, distinguished by its very long collar and flat triangular head, from Brazil; Pronæus *Latr.*, having immense sickle-shaped mandibles; and Planiceps *Latr.*, having the collar long and square, and the head flat.

The family Scoliidæ* (including the Sapygides) is distinguished by having the collar laterally extending to the base of the wings

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* Bibliogr. Refer. to the Scoliidæ.

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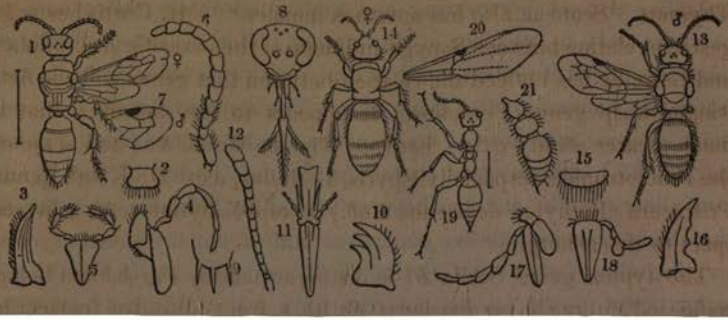
De Romand, in Ann. Soc. Ent. de France, 1835, p. 653. (Epomidiopteron ♀.) — Ditto, in Trans. Entomol. Soc. London, vol. ii. — Ditto, (♂).

Guérin. Prodrome Monogr. Myzine, Extr. Dict. Pittoresq. d'Hist. Nat. tom. v. p. 575. June 1837. — Ditto, Synops. Monogr. Plesia, in Révue Zoologique, tom. i. p. 56. — Ditto, in Voy. de la Coquille.

Fig. 84.



(*fig.* 84. 1. Tiphia femorata ♀, 2—6. details of ditto). The labrum (*fig.* 84. 2.) is scarcely exserted. The legs are short and robust, the tibiæ being thick, spinose, or denticulated, the basal joint of the tarsi being scarcely emarginate. The eyes are often lunate. The antennæ are generally short, thick, and more or less serrated and convoluted in the females. The abdomen is elongate-ovate, and attached by a short peduncle. Both sexes are winged, and the females are furnished with ocelli, as well as the males. The males are generally narrow and elongated, with the abdomen terminated by three spines (*fig.* 84. 9.). The body is often very hirsute. Some of the species, which are for the most part exotic, are of a very large size, but the habits of the majority are unknown; we may, however, judge from analogy, that the majority, on account of the structure of the legs of the females, burrow in sand.

Latreille, in his later works, has divided this family into the Scolietes and Sapygides; the former distinguished by the thick spined legs and short convoluted antennæ; and the latter by the slenderness of the legs and long straight antennæ. Dr. Leach accordingly formed them into the two families Scoliadæ and Sapygidæ. In his *Genera Crustaceorum*, however, Latreille more naturally united them into one family. I have, therefore, considered them only as subfamilies.

The relation of these insects with the Mutillidæ is very close; the males of the Mutillideous genus Methoca having been placed by Latreille in the subfamily Scoliides, under the name of Tengyra, and

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Westwood, in Proceed. Zool. Soc. 1835. (Meria, Anodontyra.)

Fabricius, Rossi, Panzer, Savigny (Egypte), *Brullé* (Morea), *Perty* (Delectus Brasiliæ). *Griffith* (An. K.), *Guérin and Percheron* (Genera).

the males of Myrmecodes in the subfamily Sapygides, under that of Thynnus. Scotæna also has apterous females.* Mr. Curtis has suggested a relation between Sapyga and some of the parasitic Andrenidæ; and Latreille has noticed the relation between that genus and the flat-winged wasp genus Ceramius. It appears to me, however, that a much nearer affinity exists between Tiphia, Meria, &c., and some of the Proctotrupidæ, especially Epyris, Bethylus, &c. Dr. Klug's genus Pristocera (Bethylus depressus *Fab.*) is especially interesting in respect to this affinity.

The typical genus Scolia *F.* is distinguished by the labium being composed of three linear divisions (*fig.* 84. 8. front of head of Scolia). It is of great extent, and comprises many very large species, inhabiting the hottest regions of the globe. M. L. Dufour, who has published an elaborate anatomical essay upon the largest European species, S. hortorum (*Journal de Physique*, September, 1818), states that they abound in the very hottest situations, and that they are particularly fond of revelling in strong-scented flowers, such as rue, &c. A correspondent of the *Entomological Magazine* (vol. iii. p. 463.) states that Scolia 2-cincta *Fab.* makes its burrows in sand-banks, to the depth of eighteen inches, with a very wide mouth; in digging into one which a female had entered, he found a large locust, L. lineola, which is probably its prey. It flies without any hum: the male is taken singly on flowers; but the males of S. interrupta and 4-punctata, which are extremely sluggish, are found crowding on the ears of grass near the sea-side, in societies of twenty or thirty, where they pass the night, and make no attempt to escape. The males of S. 6-cincta (?) are found in similar localities; but the male of another species was solitary, and generally found on the flowers of the bramble, and was tolerably active. The males have the extremity of the abdomen tridentate (*fig.* 84. 9.).

The species of this and the allied genera have been investigated by Dr. Klug, in Weber and Mohr's *Beitrage*, above referred to. According to St. Fargeau (*Enc. Méth.* tom. x.), the females of Tiphia (*fig.* 84. 1. T. femorata ♀; *fig.* 84. 2. labrum; *fig.* 84. 3. mandible;

* The females of the genus Myzine *Latr.* have not yet been discovered; but from analogy with Tengyra, I have little hesitation in considering that they are apterous, as suggested by Van der Linden and Guérin, the former considering it probable that the Mutilla diadema *Fab.* may be the female of Myzine cylindrica. Plesia, which has been regarded as the female of Myzine, is more nearly related to Tiphia.

fig. 84. 4. maxilla; 84. 5. labium; 84. 6. antenna ♀), which is the only genus of the first subfamily found in this country, make perpendicular burrows in sandy situations, for the reception of their eggs; but the precise food stored up for the larvæ has not been observed. The veins of the wings of this genus do not extend to the extremity of the wings; they also vary in the sexes, the marginal cell being closed at the extremity in the males, but open in the females, which are further distinguished by having the extremity of the wing notched (as is also the case in Meria; *fig.* 84. 7. represents the extremity of the wing of the male of Tiphia).

Sapyga *Latr.*, the typical genus of the second subfamily, is distinguished by the long and more or less clavate antennæ (*fig.* 84. 12. antenna, 84. 10. mandible, of S. 5-punctata). The perfect insects are found, in the hottest part of the summer, flying over walls, palings, &c.; but their economy has been the subject of various opinions. Thus St. Fargeau remarks (*Enc. Méth.* tom. x. p. 338.), that the females [which are destitute of ciliæ to the fore legs] make burrows in the mortar of walls, or in wood, in which they deposit their eggs, with a supply of food; adding, that he had taken S. punctata carrying an insect, which it let fall the moment it was seized, and which St. Fargeau observed was a larva. Latreille, however, suspects that the species are parasitic upon some of the bees, which build in old wood; and Mr. Shuckard states that he had caught S. punctata entering into the cells of Osmia bicornis in a sandy lane at Bexley. Mr. Bakewell also had observed it thrusting its abdomen into the nests of Osmia cærulescens, as quoted by Mr. Shuckard (*Trans. Ent. Soc.* vol. i. p. 58.). My own observations (*Ibid.* p. 202.) also seem to prove that it is parasitic. Robineau Desvoidey has, however, proved this fact, having found the cocoons of S. punctata in the cells of Osmia helicicola *R. D.* (so named from making its cells in empty snail-shells); in which situation he observed the metamorphoses of the Sapyga, without, however, having detected the female in her operations. He also observed S. Chelostomæ enter the cells formed and provisioned by Chelostoma. My *fig.* 84. 11. represents the labrum of this species, extracted from a specimen just killed; the ligula and its paraglossæ (which are not represented in Mr. Curtis's figure, evidently drawn from a dried specimen) being long and exserted. I have also observed the eggs of S. punctata, which are of a large size, being a line long, and of an elongated oval form, slightly thickened towards one extremity.

The family MUTILLIDÆ*, corresponding with the Linnæan genus Mutilla (*fig.* 84. 13. Mutilla Europæa ♂, 14. ditto ♀, 15—18. details of a large Mexican species, ♀), is composed of insects which are solitary in their habits, and of which there are only males and females†, the latter of which are destitute of wings, with the segments of the thorax often soldered together; this sex is also destitute of ocelli, but they are provided with a powerful sting. The antennæ are filiform, or setaceous, the first and third joints being elongated; the first, however, is not equal to the one third of the entire length of these organs: the labrum is transverse and ciliated (*fig.* 84. 15.); the mandibles more or less notched (*fig.* 84. 16.); the maxillary palpi with the basal joint very small (*fig.* 84. 17.), the ligula not produced, and the labial palpi with the third joint more or less dilated (*fig.* 84. 18.). The body is often very much clothed with hair.‡ The legs of the females are very robust, with the tibiæ and tarsi spined and ciliated, as in the other true Fossores. The sexes of the same species often vary very considerably in colour. They are generally found in hot sandy situations, the majority being exotic, very few occurring in our own country. The females run with very great quickness, secreting

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* BIBLIOGR. REFER. TO THE MUTILLIDÆ.

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Klug, in Nova Acta Cæs. Nat. Curios. vol. x. p. 2. (Brasilian Mutillæ.) — Ditto, in Entomolog. Monographien. — Ditto, in Ehrenb. Symbolæ Physicæ.

Swederus, in Stockholm Trans. 1787. (Sp. of Mutilla described.)

Van der Linden, Note on Tengyra and Methoca, in Ann. Sc. Nat. tom. xvi. 1829.

Guérin, in Voyage de la Coquille. — Ditto, in Mag. Zool. Ins. No. 6. (Mutilla Senegalensis.)

Waltl. Reise nach Spanien (n. sp. Mutillæ descr. by Klug.)

Say, in Journal of Nat. Hist. Soc. of Boston, vol. i.

Olivier, in Encycl. Méth. tom. iii.

Westwood, in Proceed. Zool. Soc. 1835. (Diamma, Trigonalys, Dorylus orientalis.)

Shuckard, in Trans. Entomol. Soc. vol. ii.

Fabricius, Perty (Delectus Brasil.), *Coquebert, Panzer, Rossi, Spinola, Brullé* (Morea), *Boisduval* (Voy. Astrolabe), *Donovan* (Ins. New Holl.).

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† Mr. Kirby speaks of neuter Mutillæ (*Introd. to Entomol.*), but evidently incorrectly, as the species, being solitary, are not provided with workers, or neuters, as they are termed.

‡ This is a curious peculiarity, considering, at the same time, that the insects frequent the hottest localities.

themselves, on the approach of danger, amongst grass, and under stones; they are always found on the ground, but the males occasionally frequent flowers.

Little has been observed with precision with respect to the habits of these insects; but it cannot be doubted, from the structure of their legs, and the situations in which they are found, that they closely resemble those of the other sand-wasps. I have, indeed, dug the female of Mutilla Europæa out of sand-banks*, and have constantly taken M. rufipes ♀ on the sand, but have never observed either in the act of burrowing. Christius, indeed, states that the former is gregarious, nidificating in company with Bombus terrestris. I have noticed that when alarmed it makes a rather sharp noise, most probably by the action of the large collar against the front of the mesothorax. M. Goureau has also noticed the same circumstance in both females and males, and attributes it to the friction of the base of the third segment of the abdomen within the preceding joint. (*Ann. Soc. Ent. de France*, 1837, p. 66.)

The males of the typical genus are furnished with a minute spine on each side of the anus, and the eyes are reniform; in both which respects the genus nearly approaches Scolia; indeed, the relation between these two families is, in several respects, extremely close.

From information given by Mr. MacLeay to Mr. Kirby, it appears that a large North American species (Mutilla coccinea) is very active, taking flies by surprise, probably for the purpose of storing its cells. Its sting is so powerful, that a person stung by one lost his senses in five minutes, and was subsequently so ill that his life was despaired of.

The females of the genus Methoca are also apterous; but the thorax is constricted into three knots (*fig.* 84. 19. M. ichneumonides), thus resembling Gonatopus and some of the ants. I have observed that, when captured, it endeavours to roll itself into a ball, by bending the head and tail beneath the breast. They are found in hot sandy situations, over which the male takes its flight. This sex is quite unlike the female, with a long slender abdomen, continuous thorax, and long antennæ (*Ent. Text. B.* pl. 3. f. 5.), and was considered by Latreille as a distinct genus, Tengyra, which was arranged amongst the Scoliidæ.

* Mr. Pickering has also dug M. Europæa ♀ out of sand banks, and observed the wings of flies amongst the sand, whence it is evident that it was upon the latter insects that the former had subsisted.

M. Van der Linden, however, ascertained that these genera were but the sexes of the same species (*Ann. Sci. Nat.* Jan. 1829, and *Bull. Ferussac*, April 1830); and Dr. Burmeister has captured the male on the wing, carrying the female during flight. (*Manual*, transl. p. 327.)

Mr. R. H. Lewis has also sent me specimens of a male Thynnus variabilis and female Myrmecoda, from Van Diemen's Land, captured by himself *in copula*, thus confirming the relations of these two supposed genera. Klug also mentions the same fact in the *Abhandl. der Akad. der Wessensch.* 1831, p. 307. The same occurs also in the genus Scotæna *Klug*, of which males only have been described; the insect figured by Perty (*Delectus An. art. Bras.* tab. xxvii. f. 10.), under the name of Myrmecoda varia, being a female of the latter genus. Mr. Shuckard also considers that the insect which he has described in the *Trans. Entomol. Soc.* (vol. ii. pl. 8. f. 1.) under the name of Psamatha chalybea, may be the male of my genus Diamma.

The exotic genus Apterogyna *Dalm.* is remarkable for the great length of the antennæ in the males, and for the curiously constricted abdomen in both sexes (*fig.* 84. 21.); the veins of the wings are carried nearly to the base of the wing (*fig.* 84. 20.). (See Dalman, *Anal. Ent.*; Klug, in Ehrenberg's *Symb. Physicæ*; and Griffith, *An. Kingd., Ins.* pl. 76. f. 5.) Psammotherma *Latr.* is distinguished by the strongly bipectinated antennæ of the males. I am indebted to Dr. Klug for a species of this genus from southern Africa, and have seen a second species in the Berlin Museum. With the exception of a species of Pompilus, in the same museum, I know no other Aculeate Hymenopterous insect which exhibits this structure.

The genus Scleroderma *Klug*, placed by Latreille in this family, appears to me to belong to the Proctotrupidæ, as I have endeavoured to prove in a monograph upon the genus, published in the 2d volume of the *Trans. Entomol. Soc.*

I may here mention another anomalous genus, which I have described under the name of Trigonalys, having somewhat of the aspect of a male Mutilla, but with the head flattened and the antennæ longer, very slender at the tips, and composed of 23 or 24 joints, very like those of Lyda; the legs are simple, and the abdomen punctured. The veins of the wings are nearly as in Myrmosa and Mutilla Europæa ♂. The type, T. melanoleuca, is from Brazil.

Latreille also introduces into this family the singular genera Do-

rylus *Fab.* and Labidus *Jur.*, consisting of insects of which males only have yet been observed, but differing from the remainder of the family in the antennæ being inserted close to the mouth, the head small, and the abdomen long and nearly cylindric. Saint Fargeau appears to regard them as more nearly related to the ants.* (*Hist. Nat. Hym.* p. 225.) The basal segment forms a strong knot. The maxillæ and labium, undescribed by Latreille and St. Fargeau, are extremely minute. Mr. Burchell has informed me that the African species of Dorylus is nocturnal in its habits.

The second division† of the predatory Aculeata corresponds with the genus Formica of Linnæus, and the HETEROGYNA of St. Fargeau;

* Such also is the opinion of Mr. Kirby. (*Monogr. Apum Angliæ*, vol. i. p. 224.)

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† BIBLIOGR. REFER. TO THE FORMICIDÆ.

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Lochner. Sciagraphia Myrmecologiæ Medicæ, in Ephem. Nat. Curios. Dec. 11. An. 8.

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[1] The first part only of this memoir, containing the Piedmontese ants (27 in number, 6 being *new*), described after the neuters alone, is here published. The author proposed to publish a more extended memoir; but his recent death will, in all probability, prevent this intention from being realised. I may here mention, that M. Brullé proposes to publish a monograph upon this family.

but, as Latreille, who proposed the latter name, also introduced the Mutillidæ into the group, I have thought it more correct to give it a distinct name, SODALES (or PHILOPONA *K.*), founded upon the circumstance, not only that the insects are social in their habits, but also because the larvæ are not enclosed in separate hexagonal cells as in the wasps and typical bees.

The single family, FORMICIDÆ, is composed of the well known and singularly interesting tribes of ants (which must not however be confounded with the Termitidæ or white ants), and which are distinguished by their habit of residing in more or less numerous societies underground; whence arises the necessity for a great number of individuals having the sexual organs and instincts rendered abortive, whereby, being freed from the latter, they are the better fitted to perform the labours of the community, for which purpose they are moreover destitute of wings; whilst the males and females are much less numerous, possessing wings, and being produced only for the propagation of their species.

The males have the body small, with the antennæ and legs long and slender (*fig.* 85.* 1. F. fusca ♂ 2—5. details of this sex); the females, on the other hand, far exceed their partners in size, with the antennæ and legs shorter and thicker (*fig.* 85. 6. F. fusca ♀ 7—10. details of this sex). Both these kinds of individuals are furnished with wings

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Gould. Account of English Ants. 12mo. London, 1747.

Wilde. De Formicâ. Rome, 1612. pp. 100.

King. Observations concerning Emmets or Ants, their Eggs, &c. (Philos. Trans. 1767.)

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Bostock, in Trans. Ent. Soc. vol. ii. p. 65. (Myrmica domestica *Shk.*)

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Dryander. Cat. Bibl. Banks. (Ants, Emmets, Formicæ.)

Fabricius, Jurine, Rossi, Spinola, Saint Fargeau. (Hist. Nat. Hymén.)

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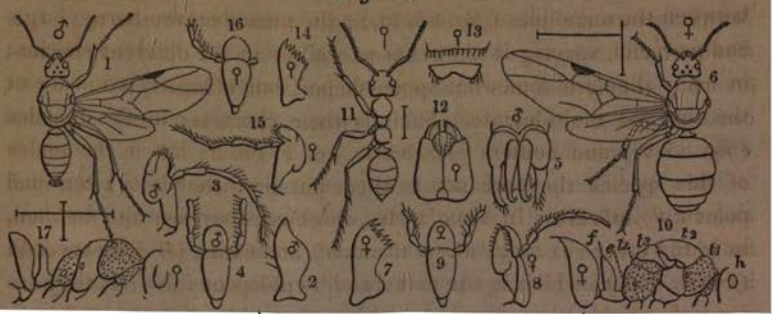
* In the various figures upon this block (85.), I have given a comparative representation of the different organs, particularly of the trophi, of the three kinds of individuals of which each species is composed. No similar comparative details have been given by previous authors. The individuals figured were from the same nest.

Fig. 85.



and ocelli, and the thorax is continuous, *i. e.*, not exhibiting any contraction in the middle; the workers or neuters are somewhat smaller than the males, with antennæ resembling those of the females, being thickened to the tips; but they are destitute of ocelli: the thorax is more or less contracted in the middle (*fig.* 85. 11. F. fusca ♀ —12—17. details of this kind of individual).

The head, including the mandibles, is more or less triangular, broader behind than the thorax in the neuters, but somewhat narrower in the males and females; the antennæ have the basal joint greatly elongated, sometimes equalling half the length of the antennæ, these organs being strongly elbowed at the extremity of this joint; they are very slender, and 13-jointed, in the males (*fig.* 86. 12.). The eyes are lateral*, not reaching to the posterior margin of the head, and rounded; the ocelli are more distinct and larger in the males than in the females; the mouth occupies a semi-oval incision on the front of the under side of the head (*fig.* 85. 12.); the labrum of the

* Latreille has described a minute species (which I was the first to discover as an indigenous insect), Ponera contracta, the neuters of which are to all appearance entirely destitute of eyes; Latreille having examined many specimens, both dead and alive, without being able to discover these organs; only twice, with a strong lens, he fancied he saw a darker coloured spot in the place of the eyes. It is found under stones, and at the roots of plants; its little assembly not consisting of more than six or seven individuals, being incapable of undertaking those measures which its more gifted brethren perform. (*Mém. Fourm.* p. 43. 197. 270.) Rennie mentions some particulars respecting this species (*Insect Miscell.* p. 118.); Latreille also described another blind species from South America, having a large head, with two knots in the abdominal peduncle. My *fig.* 86. 17. represents another species (Typhlopone fulva ♀ *Westwood*), in which I cannot detect the slightest vestige of an eye. It was found dead in sugar, by C. C. Babington, M. A., &c.: another blind species was observed by Lund, in Brazil, which he thence named Myrmica typhlos.

neuters is horny, strongly emarginate, and introduced perpendicularly between the mandibles (*fig.* 85. 13.); the mandibles are horny, large, and powerful, varying in the sexes as well as in the different species: in many they are somewhat spoon-shaped, but obliquely truncate at the tip, and multidentate. Such is their character in the females (*fig.* 85. 7.) and neuters (*fig.* 85. 14.) of F. fusca; but in the males of this species they are not toothed, but produced into a terminal point (*fig.* 85. 2.). In some males, however, they are also toothed, as in the other sex (*fig.* 86. 13. mand. of Stenamma (*W.*) Westwoodii (*Steph. Cat.*); whilst in the neuters of Typhlopone fulva *W.* they are somewhat sickle-shaped and serrated on the inner edge (*fig.* 86. 18.). In the neuters of others they are very long, linear, and deflexed at the tip.* In Myrmecina, they are said by Curtis to be wanting in the males. The maxillæ are coriaceous, small, and terminated by a broad, rounded, thin lobe, which defends the sides of the labium; the maxillary palpi vary in the number of their joints from six to two. In Myrmica and Formica they are 6-jointed and of considerable length, scarcely varying in the sexes (*fig.* 85. 3. max. ♂, 85. 8. max. ♀, 85. 15. max. ♀ F. fusca). In Atta and Cryptocerus they are scarcely as long as the maxillæ, and 5-jointed (*Hist. N. Fourm.* p. 33.). In Polyergus and Ponera there are five or four joints, and in Myrmecina Latreillei and Stenamma Westwoodii, four (*fig.* 86. 14.). In Pheidole providens *Westw.* (Atta p. *Sykes, Trans. Ent. Soc.* vol. i. pl. 13. f. 5.), and Typhlopone fulva *W.* (*fig.* 86. 19.), I have only been able to detect two joints in the maxillary palpi. The mentum is small, corneous, and cup-shaped; the labium membranous and rounded, but often, especially in dried specimens, it shrinks into the mentum. In the three kinds of individuals of F. fusca (*fig.* 85. 4. labium ♂, 85. 9. ♀, 85. 16. ♀), there is no material difference in these parts, nor in the labial palpi, which in that genus are 4-jointed: in Polyergus rufescens, Myrmecina Latreillei, and Stenamma Westwoodii, they are 3-jointed (*fig.* 86. 15.); whilst in Atta cephalotes, Pheidole providens,

* From the important share which these organs take in performing the duties of the individuals, especially of the neuters, it is evident that their various forms imply a diversity of habits with which we are, however, unfortunately, in many cases ignorant: thus, in Polyergus, which does not labour, but compels the species which it has made its slaves to perform its work, the mandibles are slender and destitute of teeth; and Latreille mentions two kinds of neuters in Eciton hamata, with different shaped mandibles, adding — "forte horum neutrorum officia pariter diversa." (*Gen. Crust. &c.* vol. iv. p. 129.)

and Typhlopone fulva *W.*, they are only 2-jointed (*fig.* 86. 20.). The thorax is very variable in its shape, especially in the neuters; its composition differs also according to the presence or absence of wings; in the winged individuals the collar is large (*fig.* 85.* 10. ♀, h the head, t 1 collar), the mesothoracic scutum (t 2) and its scutellum (t 3) distinct from each other; the metathoracic præscutum (t 4) and its scutellum (e) also distinct, the collar and the metathorax exhibiting a spiracle on each side. In the neuters, however (*fig.* 85. 17.), the composition of the thorax is quite simple, consisting of the three segments quite distinct from each other, and each provided with a spiracle on each side.

The abdomen of the males is composed of seven segments, but in the females and neuters of only six; the first, and in some genera also the second (as in *fig.* 86. 16.), forms a lenticular scale or knot, varying in form, and serving as a peduncle to the abdomen. Some of these species, especially those which have only a single scale, are destitute of a sting†, and in such case the abdomen is larger in the females than in those species which are armed with that instrument, which exists invariably in those species which have the peduncle formed of two knots. The males of the former species have the abdomen more trigonate, whilst in the latter it scarcely differs in form from that of the females. The external sexual organs of the males of Formica fusca are represented in *fig.* 85. 5. The wings are of large size, and of a delicate texture; they exist only in the males and females; they are furnished with much fewer cells than in the wasps, &c., and the veins of the wings are often irregular: thus, in the wing of Myrmica (*fig.* 86. 10.), a vein will be perceived to terminate abruptly in the middle of the first submarginal cell. The legs are of moderate or considerable length; they are generally simple, unfurnished with fossorial ciliæ, with the tarsi 5-jointed.

* In figures 85. 10. & 17. the prothorax and metathorax are dotted, to distinguish them from the mesothorax. A comparative examination of these two figures with those given in previous pages of the composition of the thorax of other Hymenoptera will, I think, most satisfactorily prove that the hind part of the thorax is not, as asserted by Audouin and Latreille, the anterior segments of the abdomen soldered to the real thorax.

† Those species which are destitute of a sting are provided with glands placed near the anus, which secrete and discharge a peculiar fluid, which has been termed formic acid, the composition of which, according to Berzelius, is as follows: — hydrogen, 2·84; carbon, 32·40; oxygen, 64·76 = 100.

See also Blot, in *Mém. Soc. Linn. Calvados*, vol. i.; and *Zool. Journ.* No. 4.

These insects have attracted the attention of the observers of Nature from the earliest time; and their untiring exertions for the welfare of the community, their devotion to the young, and their carefulness in the collection and storing up of various materials, have led to their being regarded as examples of surprising instinctive foresight: thus Virgil says—

"—— parcum genus est, patiensque laboris
Quæsitique tenax et quod quæsita reservet."

Solomon, however, more explicitly informs us of the reason for this solicitous accumulation; teaching at the same time a profound moral lesson: "Go to the ant, thou sluggard, consider her ways, and be wise; which having no guide, overseer, or ruler, provideth her *meat* in the summer and gathereth her food in the harvest."* (Proverbs vi. 6, 7, 8.). By various commentators and naturalists, however, who considered this passage with reference only to the proceedings of our northern species of ants, (the males and females of which perish towards the end of the autumn, and the neuters remain in a torpid state through the winter,) it has been contended that there were no real grounds for considering that these insects do lay up food for consumption during the winter (the supposed grains of corn having been shown by Gould to be the grain-like cocoons of the insect); whilst others have endeavoured to reconcile the statement with the habits of our indigenous species: thus Kirby and Spence (*Introd.* vol. ii. p. 47.) contend that the words do not imply a storing up of food for future use, but merely that the ant gathers the food most suited for its use during the most plentiful season. Latreille, on the other hand, considers that this foresight has for its object the augmentation and defence of the nest against the storms of winter, the stores consisting merely of building materials, and not of food.

I would, however, adopt, in preference to either of these views, that previously given by the former authors; namely, that the observation can only apply to the species of a warm climate, the habits of which are probably different from those of a cold one. St. Fargeau, indeed, states that in mild winters he had seen ants at large in every month; and Colonel Sykes, in his history of Pheidole providens *W.*

* This ancient opinion was supposed to be confirmed by the instinct asserted to be possessed by the insects of preventing the grain stored up from vegetating, by depriving it of its corculum; but more careful observers discovered that the gnawing open of one end of the grain-like cocoon had been mistaken for the former operation.

(*Trans. Ent. Soc.* vol. i. p. 103., Atta p. *S.*), has clearly proved that this Indian species collects so large a store of grass seeds as to last from January and February, the time of their ripening, till October; having observed, on the 13th of the latter month, these insects engaged in bringing up their stores of seed to dry it after the closing thunderstorms* of the monsoon; and M. Lund observes, that the species of ants in Brazil, instead of disappearing during the three months of winter, appear rather to augment in their numbers in consequence of the great migrations which take place during those months. Dolichoderus attelaboides *L.*, however, which subsists upon the saccharine fluid secreted by the Cercopidæ, retires to its nests during those months, evidently in consequence of there being none of the last-named insects during that season from which it might obtain a supply of food.

There are many peculiarities in the history and development of these insects, which require a more careful investigation than has hitherto been given to them. Our countryman Gould, and the Swiss naturalist Huber, have indeed made us acquainted with many of the secrets of the formicary, to which I can but very slightly allude. The nests are generally made underground, but they differ considerably as to their construction: some species (F. fusca, &c.) merely remove the particles of earth, thereby forming large chambers and tunnels, to which our railway-tunnels offer but a poor comparison; others (F. rufa, &c.) collect great quantities of materials, consisting of bits of straws, sticks, &c., heaped up into a conical mass, well known under the name of ant hills, the interior of which, notwithstanding its rough outside, exhibits an admirable arrangement: others, again, construct them of earth, similarly elevated, many of the cells being above, and others below, the surface of the earth: others, again (F. fuliginosa), construct them in the trunks of old trees, which they gnaw into numberless stories; and others use sawdust in forming their buildings, stiffening it into a kind of *papier maché*. F. flava (Formica bispinosa *Oliv.* fungosa *Fab.*), an inhabitant of Cayenne, constructs its nests of the cottony matter enclosed in the capsules of Bombax, forming it into a spongy mass (Latr., *Hist. Nat. Fourm.* p. 134.; Lescalier, *Tabl. Cayenne* p. 151.), very serviceable as *amadou*, or as a material for stopping the most

* It may, however, be observed, first, that a very large quantity of grain remained after the season of dearth was over (leading to the supposition that it had not been employed for food); and, second, that the known nutriment of ants consists of animal and vegetable *fluids*, and not of grain.

violent discharges of blood. M. Lund has described a species of Formica (F. merdicola *L.*), which constructs its nest upon the stems of reeds at some distance from the ground, or upon the spiny trunks of some kind of palm trees, using in its construction the dried excrement of horses and mules. Colonel Sykes also describes a species (Myrmica Kirbii *S.*, *Trans. Ent. Soc.* vol. i.), which attaches its nest to the branches of trees and shrubs, composed of a multitude of thin folia of cowdung imbricated like the tiles upon a house, the upper folium covering the whole upper part like a skull-cap. The neuters throw the abdomen over the back, or, when alarmed, carry it in an upward situation: such is also the case with Formica elata *Lund*, which builds its nests on the trunks of trees, of earth mixed with leaves. Spix and Martius (*Reise*, vol. iii. p. 1283.) mention a species of ant which forms its nest of minute hairs of the leaves of one of the melastomaceous trees; and also that F. molestans *Latr.* (nana *D. G.*) makes a small globose nest of very minute hairs of plants in the oblong vesicles of Marieta, and in the inflated petiole of Tococa.

A green ant, which inhabits New South Wales, was observed in Captain Cook's voyage, which form their nests sometimes as large as a man's head, in trees, by bending down the leaves and gluing the tips together (Hawkesworth, *Account of Cook's First Voyage*); and in the *Saturday Magazine* (No. 330. Aug. 26. 1837.), in an anonymous account of the habits of the ants of New South Wales, it is stated that a very small ant in the Bungo Forest builds nests of indurated clay, eight or ten feet high, whilst the large red and black ants (evidently species of Myrmecia *Fab.*) reside in nests scarcely raised above the surface of the ground. They are able, however, to bite and sting with great violence.

Throughout the greater portion of the year the community consists only of neuters, but during the summer the males and females are produced in considerable numbers: these are detained prisoners in the nest for a certain time, until a favourable day, or more commonly a warm still afternoon, when they make their escape, and take flight in great swarms, flying into the air, where the union of the sexes takes place: soon after this the males perish, but the females, descending to the earth, immediately tear off their own wings and commence the establishment of a new colony, or are seized and forcibly detained by the neuters for the maintenance of the old habitation. They then commence laying their eggs, which are very minute (but increase in size previous to the bursting forth of the larva); and, according to

Gould (p. 35.), those which are destined for the necessary supply of future females, males, and neuters, are deposited at three different periods. We are ignorant, however, of the peculiar circumstances by which the abortiveness of the neuters is effected. In the hive bee this is known to be produced by the female larvæ being fed with a less nourishing kind of diet than that which is given to the larvæ which are to produce fruitful females or queens; but the differences which exist between the female and neuter ant are far more striking than those between the queen and worker bees. In the ants, for instance, not only are the organs of sex obliterated in the workers, but they have a thorax of a totally different form from that of the females, and are moreover destitute of wings; the period when this loss of the wings and modification in the form of the thorax takes place, is probably simultaneous with that when the sexual organs are rendered abortive; but the circumstances connected therewith, although of great physiological interest, have not been yet observed. Another peculiarity also exists; namely, that certain individuals, few in number, amongst the neuters, are of a larger size, and furnished with much larger heads than the ordinary workers.* These individuals were first observed by Gould, and subsequently by Latreille; and they appeared to the former to be equally employed in the labours of the nest with the ordinary workers, although Huber could not ascertain their office in the nests of F. rufescens. According to M. De la Cordaire, these specimens (at least in a South American species allied to Atta cephalotes) appeared to be employed as defenders of the nests, and in capturing in their excursions. I have already also alluded to the existence of two kinds of workers belonging to the Eciton hamata; and Latreille has noticed other species in which he has found this "variété constante," especially in F. structor, the difference in size between the two kinds of neuters of the latter being so great that they would be mistaken for different species. We are, however, indebted to M. Lund for a more precise notice of the employment of these few large-headed neuters in a Brazilian species of Myrmica. Having observed a column of ordinary neuters issuing from an aperture in the ground, each loaded with food, he perceived that the aperture was guarded by four of these large-headed individuals, a few of which were also noticed in the column, but not

* A similar circumstance also occurs amongst the neuters of the hive bees. Huber has named the smaller individuals "abeilles nourrices," and the larger ones, which secrete wax, "abeilles cirières."

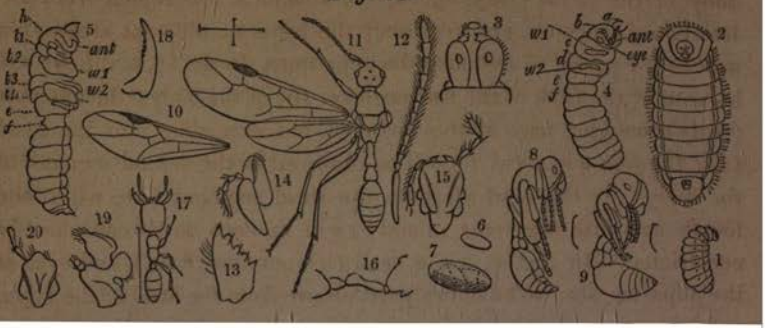
taking any part in the transport of the food: on disturbing the route and killing some of the ants, these individuals hastened to the spot, alarming the others, but gave themselves no concern with their dead companions: when order was restored, the aperture was observed to be guarded by nine of these individuals.*

Independent of the difference of habits in these two kinds of neuters, and of the modifications in their structure according therewith, their development is especially interesting as connected with that of the ordinary neuters. We can, it is true, as yet only employ analogy in considering the subject; but as we know that the neuter bee is produced from ordinary female eggs, the loss of certain characteristics taking place during its development, which the worker bees have the power to prevent, and to restore the larva, which had been destined for an imperfect female (or neuter), to its original normal character,—so in the ant, we may consider not only that the neuter is a modified female, but further, that the inhabitants of the nest have the instinct so to modify the circumstances producing this state of imperfection, that some neuters shall exhibit characters at variance with those of the common kind. It is in the consideration that such a power is possessed by the inhabitants, of thus modifying the larvæ produced from female eggs into three different kinds of individuals, that I find a confirmation of the opinion which I expressed in a preceding page, relative to the development of the different kinds of individuals composing the community of the white ants.

The transformations of Myrmica rubra have been carefully traced by Swammerdam (*Book of Nature*, pl. 16.); De Geer has also given very ample details and figures of the various states of different species of Formica and Myrmica, especially of F. rufa and M. rubra. (*Mém.* tom. ii. pl. 41—43.) The larvæ have the appearance of small white grubs or worms, destitute of feet; they are short, thick, and somewhat conical, being narrowest towards the head, which is bent

* M. Wesmael has just forwarded to me his notice of a singular Mexican ant, (Myrmecocystus Mexicanus), in which the neuters exhibit two still more remarkable modifications of form, some being of the ordinary form of neuter Formicæ, whilst in the others the abdomen is swollen into an immense subdiaphanous sphere, produced by the distension of the membrane connecting the abdominal segments. According to the notes of the discoverer of this species, and the observations of M. Wesmael in support thereof, the latter individuals do not quit the nest, are almost inactive, and are occupied only in elaborating a kind of honey, which they subsequently discharge into cells analogous to those of the hive. (*Bull. Acad. Roy.* Bruxell. tom. v. p. 771.)

Fig. 86.



down upon the breast (*fig.* 86. 1. larva of F. rufa seen sideways; 2. ditto magnified, seen from beneath, after Ratzeburg). The body is composed of the head and twelve segments. The head (*fig.* 86. 3.) is furnished with two small horny hook-like pieces, which, although evidently the analogues of the mandibles, are too wide apart to be used as such; below these are four small points or bristles, two on each side, and a subcylindrical, soft, fleshy lobe, which is retractile, and by the assistance of which the larva receives its food from the workers, consisting of a nutritious fluid which they have previously elaborated in their stomach, and subsequently disgorged. Honey dew, and other saccharine fluids collected from different vegetables, probably form its chief base. De Geer, however, records the circumstance, that he had observed the neuters destroy and devour the young larvæ which they had previously guarded with such great tenderness. Possibly their instinct might have inspired them with despair of ever rearing these unfortunate larvæ. A peculiar duty of the neuters consists in removing these larvæ and the pupæ, from time to time, to various parts of the nest, where a proper degree of temperature exists. Latreille has even observed that the neuters of Myrmica Cæspitum keep the larvæ and pupæ separate. Dr. F. T. C. Ratzeburg has made the segmental development of these insects the subject of an elaborate memoir, to which I have already alluded (in p. 79.), his chief object being to prove that the head of the pupa is composed of the head and first segment of the larva (the eyes of the pupa being visible through the skin of the hind part of such first segment of the larva), and that the fifth segment of the body of the larva (exclusive of the head) becomes the peduncle of the pupa; the metathoracic præscutum (*fig.* 85. 10. t. 4.) and the metathoracic scutellum (85. 10. e) respectively occupying a separate segment of the

body of the larva. My figures 86. 4. and 5. are copied from Dr. Ratzeburg's memoir, and represent the larva at different stages, but near to the period of assuming the pupa state. In *fig.* 86. 4. the eye will be seen at the back of the first segment (b) of the body; the antennæ (ant.) occupying part of this segment, but extending into the head (a); the fore wings (w. 1.) will be observed in the second segment of the body (c); the hind wings on the third segment (d); whilst the fourth and fifth segments (e and f) will be seen to be considerably constricted. In *fig.* 86. 5. the head (h), antennæ (ant.), and eyes of the pupa, are seen to be entirely withdrawn from the head of the larva, and to occupy the first segment; and as the peduncle is still more decidedly seen to occupy the fifth segment (f), it follows that the collar (t. 1.), mesothoracic scutum (t. 2.), and scutellum (t. 3.), and the metathoracic præscutum (t. 4.), and scutellum (e), must be the three intermediate segments. Without intending to express any doubt as to the correctness of Dr. Ratzeburg's actual observations, I cannot admit the theory by which he endeavours to account for the appearances he has described. As already noticed, in p. 79., the necessarily increased size of the head of the imago*, requisite for the support of organs to be employed by an insect in searching for its own food (whereas in the larva state there was no need of highly developed trophi, the insect being fed by others, and that merely with a thickened liquid), together, also, with the equally necessarily increased size of the mesothorax requisite for the support of the large pair of fore wings, and the consequent decrease in size of the prothorax and its collar, must equally necessitate a diversity of size in the segments of the pupa (although still invested in the larva skin); hence we find the head so much increased in size, that it is pushed back so as also to occupy the first segment of the larva; the prothorax (t. 1.), on the other hand, is so reduced in size, that it cannot be said to occupy a segment of itself; so that we may either consider it as forming part of the first segment with the head, in which case no anomaly will exist, the head and prothorax of the pupa occupying the head and first segment of the larva, or we may regard it as part only of the second segment, the remainder being occupied by part of the mesothorax of

* I am happy to learn from the most able entomotomist our country has yet produced, G. Newport, Esq., that my view of this subject is fully confirmed by the nervous system of the animal at the period of its undergoing these changes, in his forthcoming article, "Insect," in the *Cyclop. of Anatomy.*

the pupa, which is the proper view of the subject; but as the wing-bearing segments of the pupa are necessarily increased in size, it follows that they are also pushed backwards, so that the peduncular scale (f), instead of occupying the fourth segment of the larva, in effect occupies the fifth (exclusive of the head). It may, indeed, be asserted, that as the body of the imago possesses two or three segments fewer than exist in the body of the larva, we may suppose that the loss of one of these segments takes place, at least, in this manner, and in this part of the body. This, however, can only be done by admitting that the head and three thoracic segments of the imago are composed of five larva-segments, instead of four, an admission negatived by all analogy with pedate larvæ; but Ratzeburg does not even imply this, because *fig.* 86. 5. is that of a male, as is proved, not only by the abdomen being 7-jointed, but also by the existence of the exserted male organs of generation.

The larvæ of those species of ants which are destitute of a sting enclose themselves ordinarily in an oval cocoon, of a dirty white colour (often mistaken for the eggs of the ants), marked at one end with a black spot, which corresponds with the hinder extremity of the body of the enclosed insect; this cocoon is composed of a very slender parchment-like envelope, formed of fine threads, spun by the larva, as Leuwenhoeck expressly describes; and is sufficiently delicate, when placed in spirits, to allow the limbs of the pupa to be seen through it (*fig.* 86. 7. cocoon of ♀; *fig.* 86. 6. ditto of ☿ Formica fusca). The larvæ of those species which are furnished with a sting do not thus encase themselves in a cocoon, the pupa being entirely naked, and at first white, but afterwards assuming a darker colour. Formica fusca, our common small brown garden ant, has afforded me many opportunities of confirming Latreille's curious statement, that sometimes the pupæ are naked, and at others enclosed in a cocoon. The precise reason for this difference has still to be ascertained. The pupa exhibits all the organs of the imago, with the limbs laid along the breast; those of the neuters being, of course, destitute of rudimental wings (*fig.* 86. 8. pupa of Myrmica rubra ♂; *fig.* 86. 9. ditto ☿). As the period draws nigh for the development of the imago, the workers gnaw a hole at one end of the cocoon, in order to form a passage for the pupa; which, having its various limbs enclosed in separate but very delicate pellicles, possesses the power of moving them immediately previous to casting off this pellicle, and of making its escape out of the cocoon; immediately after which it disengages its

limbs from their sheaths, its wings extend, its colours become darker, and in a very short time it assumes all the characters of the imago.

It would be impossible, and indeed out of place, in a work like the present, to enter into the details of the history, manners, and economy of these tribes, which vary in almost every species, and of which so much has been written. Those who would learn the details of these interesting subjects should consult the admirable memoir of Huber, the monograph of Latreille, or the second volume of the *Introduction to Entomology*, in which the greater portion of the seventeenth letter is devoted to this family. Herein, and in other general works, such as those of St. Fargeau, De Geer, &c. (Ray, in his *Philosophical Letters*, has also given many interesting details relative to the habits of these insects), we find detailed accounts relative to the swarming of the sexes; the duties of the impregnated females; the various labours of the neuters; the language, or mode of communicating the knowledge of various facts amongst the latter; their wars and combats*; the exceeding fondness of ants for the saccharine fluid emitted by the Aphides and Cocci, termed honey dew; and the pains which they take in securing it, by regularly milking the Aphides†, which they even imprison in their nests; the emigrations of their surplus population; the attempts of the latter, when established in their new habitations, to induce others to join them; their nocturnal labours (and

* These wars generally take place between the *neuters* of the same species inhabiting nests near each other, the individuals from each distinguishing, by some strange instinct their own companions; but occasionally between neuters of different species. T. W. Bond, however, asserts, that a battle lasting an entire day was observed between *winged* ants flying in the air, one army consisting of black and the other of red ants. (*Ent. Mag.* vol. iv. p. 221.) I apprehend, however, that this was only the ordinary swarming of a nest for the union of the sexes. (And see *Mag. Nat. Hist.* No. 18.; and Hanhart, *loc.. cit. suprà*, translated in *Time's Telescope*, 1829, p. 111.)

† Huber has particularly described the mode in which this is performed, observing that during the autumn and spring months many species of ants keep a brood of Aphides in their nests, guarding the eggs of the Aphides with the greatest care. (See also Gen. Hardwicke, in *Zool. Journ.* No. 13., "On the Loves of the Ants and Aphides," and *Mag. Nat. Hist.* No. 12. May 1830.) Their fondness for sweets of every kind is indeed well known, and Col. Sykes has given a remarkable case of instinct, in which an Indian species (F. indefessa *Sykes*), contrived to make its way to a sideboard of sweets by swimming over the water in which the legs of the table were immersed, and even leaping from the wall upon the table. (*Trans. Ent. Soc.* vol. i.) See further Drury's account of the ravages of ants in tropical climates, especially upon saccharine matters, chiefly from information given to him by Smeathman. (*Illustr. Exot. Ent.* vol. ii. p. 80. 2nd edit.)

see Kirby, in *Trans. Ent. Soc.* vol. i. p. xxv.); their singularly constructed tracts; their great perseverance and strength *; their repose, and diversions during their moments of relaxation, &c.: whilst in the first volume of the *Introduction* we find numerous notices of the injuries which they occasionally commit; the devotion and behaviour of the neuters to the eggs, larvæ, and pupæ, and the various modes of formation of the nests, are also therein fully described.

The exotic species, it is true, although affording many singular forms, have been but slightly studied in respect to their habits; indeed, on the contrary, much evidently fabulous matter has been published respecting them.

Some of these exotic species are of a comparatively large size, exceeding an inch in length; and the forms of many of them are exceedingly singular, some having an enormously large head; others have the jaws disproportionately long; in some the thorax is armed with numerous spines, whilst in others this part of the body and the peduncle of the abdomen are composed of a series of elongated knots.

The species of these insects inhabiting the tropical parts of the world are not only larger, but far more numerous, both in the number of species and of individuals, than those of our countries. This is especially the case in the vast elevated plains in the interior of South America, where the largest of the species of birds and Mammalia which subsist entirely upon ants, such as the Myrmecophaga jubata, Dasypus giganteus, destroy them in inconceivable numbers. M. Lund, indeed, supposes that in these climates, from their great agency in removing obnoxious matter, they become the representatives of various other families of insects, such as the Carabidæ, Necrophaga, and other carnivorous species, which are but rarely met with. Indeed, the inhabitants of Rio Janeiro sometimes even introduce them into their dwellings, in order to rid them of the visits of the Cupion, as the Termitidæ are named, considering that there is a natural antipathy between these two tribes. M. Lund, however, mentions an instance in

* The pertinacity of these insects, in their attacks upon others many times exceeding them in size, is extraordinary. I have often seen large preserved beetles, &c., to which a minute ant was attached by its jaws, having chosen to die rather than let go its hold. In this manner Formica elongata *Oliv.* seizes, "et d'une manière opiniâtre," the antennæ and legs of a green Melolontha of Tranquebar, and I have myself captured a bee on the wing, to the extremity of one of the tarsi of which the head alone of an ant remained fixed by the jaws, the body of the ant having evidently been torn off, without the insect quitting its hold. W. W. Saunders has met with a similar instance.

which a colony of ants and of white ants were established in the same abode; but that, on disturbing the nest, the ants attacked the workers of the white ants, which they perhaps considered as the authors of the mischief. General Hardwicke, however, expressly mentions that the ants in India are formidable enemies to the white ants, each ant seizing and carrying off its victim whenever opportunity occurs for so doing. (*Zool. Journ.* No. xiii. p. 114.) On the other hand, however, their ravages upon the vegetable productions of those countries are far more to be dreaded; as in the instance of the attacks of Formica saccharivora *Linn.* upon the sugar canes in the island of Grenada, whereby the cultivation of that plant was entirely put a stop to, and a reward of 20,000*l.* offered for an effectual mode of destroying the ants. (Castle, in *Phil. Trans.* vol. xxx. p. 346., quoted by Kirby and Spence, vol. i. p. 186.) See also Guilding (in *Mag. Nat. Hist.* No. 27.), on the ants of the West Indies; and an article in the *Entomol. Mag.* (vol. iv. p. 108.), of the "plague of ants" in New Spain, from Herrera's *Decades;* likewise an article on the same subject in the *London Magazine*, October, 1827.

The Jesuit Dobrizhoffer, in his work (*De Abiponibus*, vol. ii. p. 375., quoted by Perty, *Delect. An. Art. Bras.* pref. p. 23., and translated in *Nat. Hist. Ins. Fam. Library*, vol. i. p. 37.), has given a detailed account of the astonishing devastations of the ants in Paraguay. The conical earthen nests of one of the species, which abounds in the plains of that country, are three or more ells high, and as hard as stone; and he adds, "Tumulos illos pyramidales prius solerter cavatos Hispani pro furno ad coquendum panem adhibent aliquando; nonnunquam eos commolunt ac in pulveres redigunt, qui rite aqua subacti ad parimentandas domos egregie valent." We cannot, unfortunately, determine the species in question. The Portuguese have an old saying, that the ants are the queens of Brazil, in order to indicate their universal powers of destruction. Pohl and Kollar also mention various obnoxious Brazilian species, especially Atta cephalotes; the female of which is, however, eaten by the natives. (*Vorzugl. Hist. Ins. Bras.*) Dobrizhoffer also mentions the same fact, as well as Azara (p. 198.), and also Barrére. (*Ess. Hist. Nat. France Æquin.* p. 197.) Lander also informs us that ants, stewed in butter, are eaten by the natives of Yariba, in Africa. (*Journ. Second Exped. into Interior of Africa*, 1829.) Drury also mentions the same fact. In our own country, an exceedingly minute species (Myrmica domestica *Shk.*) has re-

cently proved exceedingly troublesome, infesting the houses in some parts of London and the suburbs, Brighton, &c., to such an extent, that the inhabitants have been compelled to quit their abodes. (See Bostock, in *Trans. Ent. Soc.* vol. ii. p. 66., for various details and experiments for its destruction.)

The account given by Madame Merian of the annual visits of immense swarms of the visiting ant (Atta cephalotes) from house to house, in South America*, and of their habit of forming large troops, each individual carrying a piece of a leaf in its jaws, was long considered fabulous, but has since been fully confirmed by Homberg, Smeathman, Hancock, Stedman, and Lund, the two last-named authors having been eye-witnesses to the entire defoliation of a tree by this species, which is thence called the parasol ant in Tobago. Lund has particularly described their mode of operation, and has also observed these marches extended through several days.

A species of this family, sufficiently common in France (F. rufescens *Latr.*, forming the genus Polyergus), constitutes a remarkable exception to the remainder of the family, in respect to its habits. This species, which Huber names the Amazon ant, is distinguished by the structure of its mouth, provided with slender simple jaws; whereby it is rendered incapable of constructing its nest, and attending to the duties of the community (which are in a great degree performed by the latter organs). They are therefore under the necessity of forming themselves into large armies, and of attacking the nests of Formica fusca and cunicularia, their object being to carry off the pupa; the insects hatched from the latter acting, in all respects, as their slaves; and as they are brought to the imago state within the nests of the Amazons, they do not feel the desire to quit their masters, but labour for the support of their abode as though it were their own; increasing

* M. Lund states that he never observed a species of the restricted genus Formica migrating, or marching in close columns, in Brazil; and that the migratory species, and those which form these compact columns, belong to the section which have the abdominal peduncle formed of two nodes, and the antennæ unconcealed.

† The fact of these Amazons carrying off only neuter pupæ seems to me to offer a more striking instance of instinct; for were they to introduce a single male or female pupa into their own nest, the consequences may be easily conceived. As it is, the proceedings of these neuter slaves, acting for their masters and their progeny with as much tenderness as they would exhibit to their own species, seems to prove that their labours are but the effect of circumstances, independent of any sense of philoprogenitiveness, as already suggested in p. 181. The situation of these slaves, toiling in a strange territory for strange masters, might at first

the size of the nest, provisioning the young, &c., whilst the Amazon ants are completely free from these duties. St. Fargeau, indeed, sees in the proceedings of these insects the perfection of instinct†; asserting that the Amazon ant is able to perform all the requisite labours itself, but, from a love of luxurious idleness, it adopts a plan for having them performed by slaves. But Huber, who discovered and closely studied the details of their history, expressly tells us that the Amazons "n'ont d'autre occupation et d'autre talent que celui de la guerre" (*Réch. Fourm.* p. 234.); and in a subsequent page he relates an experiment, in which the greater part of a number of Amazons, placed in a glass case with their pupæ, died from want; but that a single F. fusca introduced into the case restored order, preserved the lives of the remainder, and raised a number of the young brood. Thus these Amazon ants ought, to a great extent, to be considered as analogous to the parasite bees, &c.; and if the *habitudes morales* of the Hymenoptera are to be considered as of primary importance in the distribution of the order, these Amazons ought surely to be removed from the working species.

Huber also discovered that a species of Formica (F. sanguinea), which Stephens gives as a species found near London, larger than the Polyergus rufescens, makes slaves of the same two species as the latter: unlike them, however, they share the labours of the nest with their slaves; and it would even seem that both species of slaves are met with in the ant hills of the sanguine ants; and Huber even brought up Polyergus rufescens and Formica sanguinea, which are both slave-makers, with F. fusca, in one common dwelling.

M. Lund also observed a Brazilian species of Myrmica (M. paleata *Latr.*), which was assisted in the affairs of its nest by the neuters of another species of the same genus (M. erythrothorax *Lund*). He also discovered a thick column of another species, forming a new genus (Ancylognathus lugubris *L.*), loaded with the larvæ and pupæ of ants, and which he considered as a party returning from a maraud-

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sight appear lamentable; but when we recollect that these slaves have been born in this state, without knowing any thing of a different state — that of freedom; that they toil not more laboriously for their masters than they would do for their own relatives if they were free; that they suffer no privations of repose or food; that they are even permitted to watch over the rearing of some of their own community; and, moreover, that the state of society dependent upon the structural peculiarities of the Polyergus requires their presence in the nests of the latter, — we are induced to hesitate before we exclaim with Sterne —" Still slavery; thou art a bitter draught."

ing excursion, rather than changing their abode, because many of the ants themselves were mutilated. (*Ann. Sc. Nat.* June 1831.)

I have above alluded to the habits of our indigenous ants of obtaining a supply of honey dew from the Aphides and Cocci; but the exotic species of the family do not confine themselves to these tribes; since, in General Hardwicke's drawings of Indian zoology, now in the British Museum, I have observed several representations, in which ants are in the act of milking the larvæ of various species of Cercopidæ; and M. Lund has also noticed the same in a Brazilian species F. (Dolichoderus *Lund*) attelaboides *Fab.*, which thus attaches itself to the larvæ and pupæ of Cercopis and Membracis. He observes, however, that this is probably owing to the entire absence of Aphides in the interior of the country (although they are occasionally found near Rio Janeiro; where, however, they had, in all probability, been imported with plants from other parts of the world). He also once found the larva of a Fulgora in an ant's nest. I may here mention having repeatedly found many very young individuals of a perfectly white colour, belonging to species of Oniscus*, in the nests both of Formicæ and Myrmicæ; and M. Lund noticed a column of Myrmica typhlos†, many of the specimens of which carried an Oniscus beneath the abdomen, the latter holding itself in that position by its short hooked legs, which gave the Myrmica a most singular appearance. Latreille also noticed Onisci creeping about at will in the nests of Formica rufa. On disturbing the nests of Formica fusca, I have almost invariably observed an extremely minute fly, belonging to the genus Trineura *Meig.*, hovering over the nest, as though it had also been disturbed, and darting at times upon the ants.

The habits of the singular Brazilian genus Cryptocerus are quite unlike those of the rest of the family. They are solitary idle creatures, fixing themselves all day long in the middle of a leaf, and when alarmed, retreating slowly sideways to the under side of the leaf. How far it is correct to assert, with Lund, that they are in no degree social, and the care of the young depends on the females, the neuters being entirely useless, has yet to be ascertained. Pohl and Kollar inform us that a large species of this genus emits a liquid which stains the flesh for several days.

* The same fact is also mentioned by Mr. Knapp (*Journal of a Naturalist*, p. 304.). Various Coleoptera, also (g. Claviger, Batrisus, Myrmechixenus, &c.), inhabit ant's nests. See Chevrolat, in *Silberm. Rev. Ent.* No. 17.

† This species is blind, a peculiarity which Lund thinks has some influence in the selection of their lucifugous companions.

M. Lund concludes his exceedingly interesting memoir by describing a singular genus, which he considers should be placed at the end of this family, and of which he had detected five or six species, neuters only having been observed with the antennæ elbowed, and with the abdominal peduncle formed into two nodes; but differing from all the known ants in the eyes, which occupy nearly the whole of the head. They are solitary, creeping upon the trunks and leaves of trees; they sting sharply. Latreille proposed for them the generic name of Pseudomyrmex.

This family of insects constitutes an exceedingly natural and isolated group amongst the Hymenoptera, &c., of which the natural affinities are very difficult to determine. Latreille, as above stated, considered them as nearest allied to Mutilla; and if we regard the structural peculiarities alone of the apterous individuals of these two groups, we certainly find many characters in common. Compare, for instance, Methoca ♀ with Formica ☿; the latter, in its want of wings, ocelli, and sting (three of the great characters of the order), being a far less perfect animal than the former. But when we examine the true nature of the ants, and especially the characters of the females, together with their social economy, we must award to the ants a relation with the more typical Hymenoptera, as the bees and wasps. It is true that, comparatively speaking, they do not exhibit so elaborate a species of economy as is shown by the type of those groups; but their habits are quite as elaborate, for instance, as those of Bombus. In placing them between the true Fossores and the solitary Fossorial wasps, I am aware that I am apparently violating nature, and such is the opinion of St. Fargeau; but until the difficult question as to the precise importance to be given to the *habitudes morales* of these insects over their *general structure* is determined, I have preferred adopting the arrangement of Latreille's most valuable work. As to the relations of the ants with the beetles and Tenthredinidæ amongst the Trichoptera, as suggested by Mr. MacLeay (*Horæ Ent.* p. 370.), I cannot conceive them to be entitled to any weight; indeed, that author has himself shown his opinion of the former relation, by stating, in a subsequent page, that Stylops (which he thinks nearest allied to the Chalcididæ) is the link between the Coleoptera and Hymenoptera; and as to the latter, suggested with the view of proving that the true Hymenoptera are allied to the Trichoptera (amongst which he places the Tenthredinidæ), and founded on the supposed similarity of their

whole shape, and the gradual disappearance of ocelli, no two insects can be more unlike than Formica and Tenthredo; whilst the latter, and even the true Trichoptera, are furnished with ocelli.

The third and last division of the subsection Prædones consists of the wasps, termed DIPLOPTERYGA* by Kirby (Diploptera† *Latr.*), from the wings being folded throughout their entire length when at rest

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Felton, in Phil. Trans. 1764. (n. sp. wasp.)

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* Mr. Kirby (*Faun. Bor. Amer.* p. 263.) has altered Latreille's name, the termination *ptera* being used for orders alone.

(*fig.* 88. 16.), (except in the genus Ceramias, in which they are extended horizontally.) These organs are always developed in both sexes, and also in the neuters of the social species. The antennæ are generally elbowed, and either filiform or thickened at the tips; they are inserted near the middle of the face, with the third joint longer than any of the following. The tongue is of moderate length, and terminated by laciniæ, which are glandular at the tip, with a pair of lateral linear paraglossæ. The palpi are short and filiform; the maxillæ are long, coriaceous, and compressed, with the terminal part less coriaceous, and separated by a transverse suture. The eyes are notched; the thorax is oval and entire; the collar extends laterally to the base of the wings. The construction of the thorax of one of the wasps (P. Billardierii *Fab. ?*) has been elaborately investigated by MacLeay (*Zool. Journ.* No. 18.).

The fore wings have one marginal, and three perfect submarginal cells, with an incomplete terminal submarginal one.

The body of these insects is either quite naked, or but very slightly clothed with hairs; it is in general of a black colour, more or less spotted with yellow or buff; the clypeus is generally unspotted in the males, but in the opposite sex it is more or less spotted with yellow. The legs are of moderate length, not furnished with organs fitted for the collection of pollen; the posterior tarsi having the basal joint neither dilated nor furnished with pollen plates or brushes. The abdomen is ovate or ovate conic in its form, and often petiolated; the sting of the females and neuters is very powerful, and has occasionally caused the death of persons who have been attacked by these insects.

The chief character upon which this division is founded, and from which it receives its name, is one of those curious instances where we find a peculiarity of organisation (apparently of very trifling nature, and which cannot, so far as we are enabled to perceive, exercise the slightest influence upon the habits of the species,) so constant and

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Valentin. Nidus Vesparum mirandus, Act. Acad. Nat. Cur. vol. ii.

Von Malinowsky. Beitr. Naturg. Vespa Crabro, Berlin Mag. 1808.

Muralto. Anatomia Crabronis, in Ephem. Nat. Curios. Dec. 2.

Strauss. Anatomie du Frelon, (V. Crabro); with 4 fig. Ferussac Bull. 1830; and in Ann. Sci. Nat. Sept. 1830.

Bigge. Observations on the Natural History of the Two Species of Wasps. Oxford, 1835. 8vo.

Fabricius, Panzer, Rossi, Spinola, Savigny (Egypte), *Coquebert, Drury, Griffith* (An. K. Synagris cornuta), *Latreille* (Humboldt), *Perty* (Brazil), *St. Fargeau.*

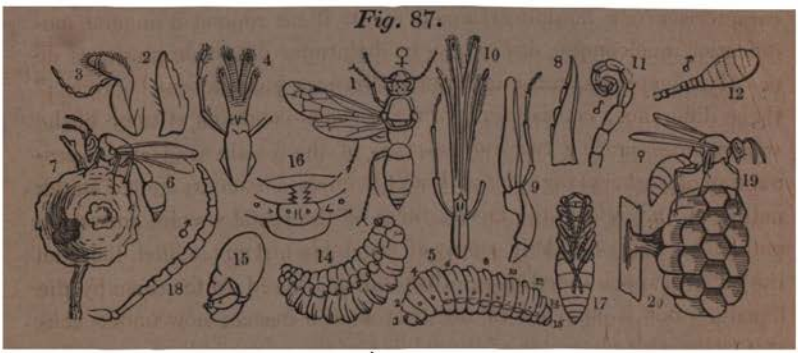
characteristic, that we look in vain throughout the whole order Hymenoptera for any other instance *; while, if we look at the habits of the species, we find them to be sufficiently striking to induce us to suppose that we might here find satisfactory cause for such a marked peculiarity; but so far is this from being the case, that whilst the typical wasps have an economy as elaborate as that of the hive bee, many species are solitary, and resemble the Fossores in their habits. To assert that a character like this ought of itself to be considered as of primary importance, and of superior weight to other structural characters modified by their diversity of economy, would be unphilosophical; and such is the view of the subject taken by St. Fargeau (*Hist. Nat. Hym.* tom. i. p. 474.), who considers that although the folding of the wings may be convenient "pour caractériser une famille artificiellement, il ne répond à aucune modification quelconque des mœurs ou habitudes d'agir de plusieurs de ces Hyménoptères, puisque leurs différences en cela sont énormes;" these differences consisting, 1st, in the social condition of some of the species necessitating two modifications of the female sex (for the production of workers) together with architectonic instincts; and 2d, in the nature of the food of the larvæ, those of the social species consisting almost entirely of a daily supply of vegetable matters, whilst those of the solitary species feed upon other insects, stored up for them by the female. But it appears to me that in the insects now under consideration, this character of the folding of the wings indicates a correspondence in the general structure of the insects possessing these different habits, apparently sufficient to prove that the "habitudes morales," of these creatures (with the peculiar modifications of the organs which are employed in performing such habits) are not of primary importance in regulating the distribution of the order. Amongst the Fossores and bees we find species which do not construct their own nests, but deposit their eggs in the nests of other species of those groups; but their larvæ devour the same kind of food as the insect for whose use it had been stored up, and thus (as already insisted upon in pp. 86. and 186.) there is no absolute difference between the two groups of insects which possess such different habits. In the present family, however, the case is much

* The identical neuration of the wings (which led Jurine to place all these insects in one genus, Vespa), the lunate eyes and the glands at the extremity of the labium, may be mentioned as equally characteristic, and at the same time apparently not more influential than the folding of the wings.

stronger*, as above indicated by St. Fargeau; and therefore, although I have not hesitated to reject the separation of the Fossores into two primary groups, founded upon their parasitic or working habits, I feel less convinced of the propriety of retaining the wasps as a single family. I cannot, however, with St. Fargeau, refer the solitary wasps to the Fossores (*Op. cit.* p. 475.), since they agree in so many of their *general* structural characters with the social wasps. I accordingly divide the Diplopteryga into two families, Eumenidæ and Vespidæ.

The family EUMENIDÆ comprises the solitary species, each being composed of males and females only† (*fig.* 87. 1. Odynerus antilope *Pz.*, 2—4. details of ditto; *fig.* 87. 6. Eumenes coarctata, 8—10. details

Fig. 87.



of E. petiolata?), having the mandibles (*fig.* 87. 2. 8.) elongate-trigonate, often narrow, and forming a kind of rostrum, in this respect resembling the Fossores (from which we learn that this elongation of the mandibles is especially fitted for seizing and carrying off other insects as prey); these organs in many species exhibit, however, on their inner edge various obtuse denticulations, proving them to be but a modified type of Vespa: the maxillæ (*fig.* 87. 3. 9.) and labium (*fig.* 87. 4. 10.) are long and bent backwards at rest; the latter is divided into four pilose setæ, terminated by glands, the two intermediate ones being the longest; the anterior margin of the clypeus is produced, and is either

* The circumstances subsequently mentioned respecting the discovery of honey in the cells of Eumenes coarctata, Polistes Licheguana, and P. gallica, may here be alluded to, as evincing the necessity for regarding the absolute separation of these two tribes of insects with distrust.

† Mr. Curtis correctly describes the Odyneri as being solitary in their habits; but he has introduced neuters into his characters of the genus, and expresses surprise that he had only been able to rear females.

truncate or emarginate; the maxillary palpi are shorter or scarcely longer than the maxillary lobe, the basal joints being elongate-cylindric; the terminal joints of the antennæ of the males are often recurved and hooked at the tip (*fig.* 87. 11. extremity of ant. of Epipone spinipes ♂); the thorax is short and truncate both in front and behind; the basal segment of the abdomen is more or less coarctate, in the typical species forming a long and narrow peduncle (*fig.* 87. 6.); the legs are not furnished with ciliæ or spines, although these insects generally construct their nests with earth in cavities of walls, old wooden palings, or in sand banks, forming a succession of cells placed end to end, in each of which an egg is placed, together with a sufficient supply of food for the entire consumption of the larva, consisting of other insects, larvæ, spiders, &c. The female then carefully closes the mouth of the cell with earth.

Réaumur (*Mém.* tom. vi. pl. 26. f. 1—10.) has given the history of a species of this family, which Latreille (*Règne An.* tom. v. p. 336.) considers to be the Odynerus (Vespa) muraria *Linn.** This insect, during the early months of summer, forms a burrow in the sand to the depth of several inches, in which it constructs its cells; besides which it builds, with the grains of sand brought up whilst burrowing, a tubular entrance to the burrow, often more than an inch long, and more or less curved, the grains of sand of which it is formed being agglutinated together; each female forms several of these burrows and deposits an egg in each cell, together with a number of green caterpillars, which it arranges in a spiral direction, one being applied against the other, and which serve as food for the larva when hatched. When the store of food is secured, the insect closes the mouth of the burrow, employing the grains of sand of which the funnel was composed for that purpose.

The larvæ of Odynerus are fleshy grubs, destitute of feet (*fig.* 87. 5. magnified), with transverse dorsal tubercles serving in their stead. The body (including the head) consists of fourteen segments and a minute anal tubercle, with ten spiracles on each side. I have reared both

* Mr. Shuckard (*Mag. Nat. Hist.* Sept. 1837) gives the muraria as identical with Odynerus (Epipone) spinipes, stating that it is the latter which constructs this trumpet-shaped tube. Such may be the case, but Réaumur's description and figure do not accord with the former species, but rather with the true Linnæan V. muraria (which belongs to a different subgenus), according to the description of the authentic specimen of the latter still in the Linnæan Cabinet, forwarded by me to M. Wesmael, and by him published in the *Bull. Acad. Bruxelles.* Ceramius Fonscolombei has similar habits.

sexes of one of the species from larvæ thus constructed; thus disproving Mr. Shuckard's suggestion, that the female larvæ will necessarily have one segment less than those of the male, as in the imago. (*Trans. of Burmeister*, p. 35.; and *Mag. Nat. Hist.* Sept. 1837. See my memoir "On the Apod Larvæ of the Hymenoptera, with reference to the Segmental Theory of Annulose Animals," in *Trans. Entomol. Soc.* vol. ii. p. 121.) In the same Transactions (vol. i. p. 78.) I have also published some notes upon the habits of Odynerus antilope, which lines its cells with mud, of which it carries small round pellets into its burrow, under the breast. It employs the green caterpillars of a Crambus? for the food of its young. Mr. Ingpen exhibited to the Entomological Society (August 4, 1834) the nest of Odynerus quadratus, which had been discovered between the folds of a piece of paper which had fallen behind some books. It was nearly six inches long and one wide, and had several openings to the cells, through which the insects, on arriving at the perfect state, had escaped; it appeared to be composed of dried mud.

H. (in *Mag. Nat. Hist.* No. 25.) describes some larvæ found in the healing of a book, apparently those of an Odynerus. Mr. Curtis also figures a species (O. parietinus), the cells of which were formed on the top of a book.

Bouché states that Od. parietum stores up flies, &c., as well as the caterpillars of Tortrices (*Naturg. der Ins.* p. 179.).

M. L. Dufour has recently communicated a series of interesting observations upon the economy of several species of Odynerus to the Académie des Sciences, but they have not yet been published. (See *Comptes Rendus*, No. 10. Sept. 1838; and *Annals Nat. Hist.* No. 8. Oct. 1838.) I am indebted to Mr. F. Smith for specimens of Odynerus lævipes *Shk.*, and its nest, first described by Mr. Shuckard (*Mag. Nat. Hist.* Sept. 1837). The cells are formed of agglutinated sand, lining the cavity of a dead stick of the common bramble, from which the pith had been excavated, probably by Osmia leucomelana, and placed end to end. Mr. Sells has found twenty-five small Lepidopterous larvæ in the nest of an Odynerus; and Mr. Saunders as many as seventy-five in the nest of Epipone spinipes. Mr. Waterhouse has also discovered Lepidopterous and Chrysomelideous larvæ in the cell of an Odynerus (*Trans. Ent. Soc.* vol. ii. p. xviii.): I have also observed and captured many specimens of O. crassicornis *Pz.* near Paris, which were always loaded with the larvæ of Chrysomela Populi, which

was extremely abundant in the neighbourhood. (See Vol. I. p. 389.) Mr. Kennedy has captured O. bidens with its prey, which consisted apparently of a Chrysomelideous larva. He also mentions finding in one of its cells a small dipterous insect. (*Lond. and Ed. Phil. Mag.* Jan. 1837.) I have described (*Gardener's Mag.* 1837) a singular instance of instinct exhibited by a species of Odynerus, which provisions its nest with the leaf-rolling larva of Tortrix (Argyrotoza) Bergmanniana, which it dislodges by introducing its sting into the rolls of the leaves, immediately running to the end of the roll in order to ascertain whether the larva was endeavouring to make its escape from its unknown enemy.

In the *Insect Architecture* (p. 26—29.) is an account of the proceedings of a species of Odynerus which forms its burrow in a brick wall, and which was infested by a Tachina, which deposited an egg in the nest; and the grub hatched from it, after devouring one of the wasp grubs, formed itself into a cocoon, as did the other undevoured grub of the wasp—both of which cocoons are presented as of an oval form and placed side by side in a large oval flask-like cell. Such habits are, however, at variance with the recorded economy of the Odyneri.

Geoffroy (*Hist. Ins. Paris*, tom. ii. p. 378. pl. 16. fig. 2.) has described a species of Eumenes (V. coarctata *Linn.*, *Panz.* (*fig.* 87. 6.) which differs somewhat in its habits from the rest of this family. This species constructs, upon the stems of plants, especially heath, small spherical nests (*fig.* 87. 7.) formed of fine earth: at first a hole is left at the top, through which the parent fills the cell with honey, and deposits a single egg therein; the hole is then closed up, and the larva, when hatched, feeds on the honey, undergoes its metamorphosis, and makes its escape through a hole which it forms at the side of the cell, which contains but a single insect.

The habits of E. Saundersii *Westw.* MSS., an Indian species allied to E. petiolata, not described by Fabricius, observed by W. W. Saunders, differ from those of E. coarctata; this insect making its cells of mud, attaching them under projections, each cell being somewhat smaller than a pigeon's egg, and sometimes two or three are placed side by side; they are well stored with green caterpillars. Mr. Saunders observed the Eumenes repeatedly at work, and found one nest in a keyhole, and another beautifully constructed inside an old flute. (*Trans. Ent. Soc.* vol. i. p. 63.) One of these nests produced a Pælopæus, evidently a parasite upon the Eumenes.

The genus Ceramus *Latr.* (Gnatho *Klug*) is very interesting on account of its upper wings not being folded longitudinally, and having only two submarginal cells, as in the Masarides; the labial palpi also, as in those insects, are larger than the maxillary, which, according to Latreille and Fonscolombe, have only four joints. Klug figures them as 3-jointed, but I can only observe two joints in C. Lichtenstenii *Kl.* M. Fonscolombe (*Ann. Soc. Ent. de France*, 1835) has given a detailed description of C. Fonscolombii *Latr.* (a species inhabiting the South of France, for which I am indebted to M. Serville), which forms cylindrical tubes at the entrance of its burrows (like Odyn. muraria), which it destroys after it has completed the construction of its nest. The genus comprises two European and two South-African species. Paragia *Shk.* has also only two submarginal cells; but its eyes are oval (not reniform), and its mandibles resemble those of the social species, whence Mr. Shuckard considers it is the Australian representative of Vespa.

Some anomalous species of wasps, forming Latreille's family MASARIDES, agree with the Eumenidæ in having the fore wings longitudinally folded and the eyes notched, but differ in the antennæ being inserted wide apart, and composed apparently of only eight joints (*fig.* 87. 12. ant. Cælonites apiformis ♂), the last being large, rounded at the tip, and forming a solid mass with rudimental articulations, indicating the terminal joints; the labium is terminated by two very long setæ, which when at rest are retractile within the basal tube of the mentum; the upper wings have only two perfect submarginal cells; the clypeus is emarginate in the centre, with the labrum inserted into the notch; the maxillæ are short and obtuse, with the maxillary palpi very small, consisting of two, three, or four joints. The insect described by Fabricius (*Ent. Syst.* vol. ii. p. 284.) from the collection of Desfontaines, and figured by Coquebert (*Illust. Iconogr.* tab. 15. fig. 4.) under the name of Masaris vespiformis, is evidently a male, from the elongated antennæ and abdomen*, which is armed on the under side with two tubercles near the base. The insect figured in the great work on Egypt, which Latreille regards as forming a distinct subgenus, is a female. I have received it from Dr.

* Fabricius nevertheless says, "aculeo *recondito* punctorio," perhaps only from analogy.

Klug, under the name of Masaris Hylæiformis* *Klug* MSS., from Egypt; the antennæ are very short, as they are in both sexes of Celonites, the males of which have the abdomen terminated by two deep notches.

The second family, VESPIDÆ (Polistides *St. Fargeau*), is here restricted to those species (including the common wasp and hornet) which live in temporary societies, consisting of males, females, and workers or neuters (*fig.* 88. 1. V. vulgaris ♂, 2—6. details of ditto;

Fig. 88.

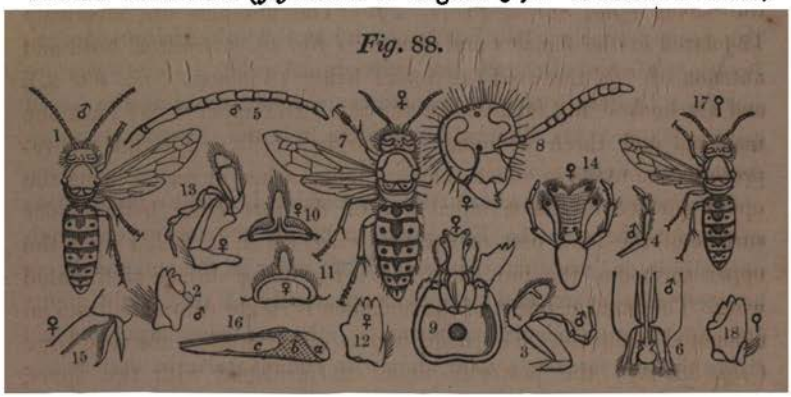


fig. 88. 7. female, 8—16. details of ditto, 17. and 18. neuter†). The upper lip is concealed by the clypeus; it is very much narrowed in front into a tongue-like piece (*fig.* 88. 10.); on the under side of it is attached a membranous plate rounded in front, which Savigny terms the epipharynx (*fig.* 88. 11.). The clypeus is nearly square, and but slightly produced in front; the mandibles are not longer than broad; their extremity is broadly and obliquely truncate and toothed; in V. vulgaris (*fig.* 88. 2. ♂, 12. ♀, 18. ♀) they are formed alike in all the individuals; they are, however, differently coloured in the male, and clothed with much longer hairs. The maxillæ and labium are but

* My specimen is also a female. Should the male agree with Celonites in having short antennæ, the species will require a distinct subgenus for its reception.

† The individuals here figured and dissected were obtained from the same nest in a bank. The observation of M. Perrot, recorded by Huber (*Nouv. Obs.* tom. ii. p. 443.), and quoted by Kirby and Spence (*Int.* vol. ii. p. 108.), of a kind of females not larger than the workers, and which produce only male eggs, requires confirmation.

slightly elongated and inflected, the maxillæ (*fig.* 88. 9. under side of the head with one of the mandibles extended; *fig.* 88. 3. ♂, 13. ♀) terminated by a short process articulated near the extremity; the maxillary palpi are longer than the lobe of the maxillæ, with the joints short, and generally obconical in form (*fig.* 88. 3. ♂, 13. ♀, the joints in the male being thinner and rather longer than in the female). The labium (*fig.* 88. 14.) is trifid, with four terminal glands, the middle division broad and but slightly elongate, and somewhat heart-shaped at the extremity, having two of these glands near its apex; the labial palpi are slender, the terminal joints varying in their proportions in the sexes (*fig.* 88. 4. ♂, 14. ♀). The antennæ are invariably 12-jointed in the females and neuters (*fig.* 88. 8. front of head and antenna of ♀), those of the males being 13-jointed (*fig.* 88. 5.), and not hooked and recurved at the tip. The upper wings have one marginal and three complete submarginal cells. *Fig.* 88. 16. represents the mode in which they are folded when at rest, a being the upper surface of the terminal part of the fore wing; b the under surface of the hind part of the fore wing, which is folded upon the upper surface of the fore part; and c the upper surface of the hind wing. The basal segment of the abdomen is rarely contracted into an elongated peduncle. The male organs of generation are very large (*fig.* 88. 6.); the posterior tibiæ are furnished with two spurs, the basal joint of the tarsi being incised on the inside and pectinated (*fig.* 88. 15.).

The economy of these insects is scarcely less interesting than that of the hive bee (with which they agree in their habit of constructing hexagonal cells arranged in combs of different size), and would occupy far too great a space were I to attempt to give beyond the slightest outline of it. The societies are, however, annual, being dissolved at the approach of winter. The nests are of varied size, according to the number of the society by which they are inhabited, being from time to time enlarged during the summer, as the community becomes more and more extensive. Previous to the setting in of the winter, the females, which have been but recently developed, are impregnated by the males, which soon afterwards die; the females then disperse, seeking winter quarters, in sheltered situations; and those which survive the rigours of winter commence the building of a new nest at the return of the spring, in which they deposit eggs and tend their young

themselves; these at first consisting entirely of neuters, which assist their parent in the duties of the nest. The nests are either built underground in holes, in banks, or are attached to branches of trees, or the woodwork of outhouses. They are composed of a paper-like substance formed of finely gnawed wood, or the bark of trees, reduced to a kind of paste by the action of the jaws, and contain a variable number of cells (sometimes amounting in number to as many as 16,000*), which are of an hexagonal form, arranged in tiers, with the mouth downwards (or opening sideways, as in Polistes, *fig.* 87. 20.), in which the larvæ and pupæ are contained. In some species (Polistes gallica, &c.) the cells are not defended by a common envelope (*fig.* 87. 20.); but in others (as Vespa vulgaris) the covering of the nest is very thick, and consists of many layers, with a circular orifice for the passage of the inhabitants. The males† and females are only developed at the beginning of the autumn, in order that a succession for the following year's nests may be insured.

These insects are very voracious, preying upon other insects‡, sugar, meat, fruit, honey, &c.§; which, after being properly prepared in the stomach of the winged insects, is disgorged, and serves as food for the young, which are fed therewith daily; the females as well as neuters assisting in this task. The males, as in all other social insects, are drones, performing no kind of labour.

Ample details of the natural history of the common wasps have been given by De Geer (*Mém.* tom. ii. pl. 26.), Réaumur (*Mém.* tom. vi. mém. 6.), Disderi (in *Turin Trans.* vol. ii. and iii.), and others, as well as by Kirby and Spence, in whose *Introduction* will be found complete accounts of their general economy; the solicitude of the females and neuters for the welfare of the young broods; the annual

* Supposing the number of cells to be 10,000, Réaumur calculates that the community would consist of 30,000 individuals before the close of the year, each cell serving successively for the cradle of three generations.

† Réaumur figures (*Mém.* tom. vi. pl. 14. fig. 3. 4.) two males from the same nest, observing that there are two sizes in this sex amongst the males (p. 206.); but in the mémoire itself he has not made any observation relative to this fact.

‡ The Americans, aware of their service in destroying flies, sometimes suspend a hornet's nest in their parlours. (*St. John's Letters to an American Farmer.*) I have watched the common wasp hovering over, and darting, hawk-like, upon flies upon excrement, careful not to soil its own legs or wings.

§ Their partiality for honey renders them very dangerous enemies to the hive, which they fearlessly enter to feed on the honey.

massacre by the neuters of the later brood of larvæ, which are not able to undergo their transformations before the setting in of the winter; the structure of the different kinds of cells and nests*; the various kinds, and the numbers of the females, neuters, and males, and their several occupations; their sentinels; the periodical diminution of their numbers, and their instinct in cases where their prey happens to be too large for their powers of flight. Mr. Newport has made some observations on this last-mentioned instinct (*Trans. Ent. Soc.* vol. i. p. 228.).

They are very susceptible of cold. I have observed a wasp, in a frosty morning in October, hanging suspended by its jaws to a curtain, with its wings closely folded up between its legs, and upon its breast.

Notwithstanding the powerful sting of the wasp, it is liable to the attacks of other insects. Rhipiphorus paradoxus and the larva of a Volucella (according to the Rev. E. Bigge) infest its nests, devouring the larva; as does also Anomalon Vesparum *Curtis* (*B. E.* p. 198.), and another species of Ichneumon, mentioned by Mr. Bigge. Dr. Leach also mentions that wasps are much infested by Lebia [Dromius] linearis. I have also observed a spider, belonging to the genus Thomisus, sucking a wasp, which it had killed.

The eggs of V. vulgaris are of a slender oval form, with a broad base. I have observed that these eggs are always attached at one of the angles of the cell, and generally in the same angle throughout an entire row of cells.

The larvæ are fleshy grubs, destitute of feet. Those of V. vulgaris (*fig.* 87. 14. somewhat larger than the natural size) are thickest in the middle, with the head small and round (*fig.* 87. 15. head seen sideways; 87. 16. the parts of the mouth in front); the labrum being slightly emarginate and transverse; the mandibles armed with three teeth; and the maxillæ and labium represented by fleshy lobes, having several minute tubercles upon them, apparently representing the palpi. Réaumur (*Mém.* tom. vi. pl. 17. fig. 12, 13., e e, p p.) represents the larvæ as furnished with two pairs of toothed jaws, as well as with maxillæ and labium; but I think this must be an error.

The sides of the body are furnished with lateral fleshy tubercles;

* I have observed, that in forming their holes or enlarging their nests, they carry out the rubbish in their jaws to a very great distance, instead of leaving it at the entrance.

and the body, including the head, consists of fourteen segments, together with a small fleshy anal lobe. The spiracles are placed along the sides of the body, almost throughout the entire length.

Each larva is enclosed in a separate cell. From the downward position of the opening of the cells, these larvæ maintain a reversed position, their heads being also downwards; they retain their situation in the cell, whilst young, by a glutinous secretion, and subsequently by the swollen front of the body, which fills the open part of the cell. They are fed by the females and neuters with honey, the nectar of flowers, or the juices of animal matter, previously prepared in the stomach of the winged nurses (or with small particles of more solid food, according to St. Fargeau), and with which they are daily supplied; the larvæ opening and shutting their jaws, when approached, like young birds. When full grown, each spins a convex cap to its cell, of a delicate, white, and slender texture, and then becomes a pupa. The cells are of different sizes, according to the sex of the intended inhabitant-larvæ, those for the females being larger than the others: the female cells are mostly placed apart from those of the males and neuters; those of the males being often mixed, but in a small number, in the neuter combs. The egg state lasts eight days, the larva state thirteen or fourteen, and that of the pupa about ten. After the imago has been produced, one of the old workers cleans out the cell, and fits it for the reception of a fresh inhabitant. The upper tiers of cells, being first built, serve for the habitation of the neuters; the females, being produced at the end of the summer, occupy the lowest tiers. *Fig.* 87. 17. represents the male pupa of V. vulgaris.

Unlike the family of the ants, the British species of this family are nearly as large as those of the tropics, the hornet being scarcely exceeded in size by any exotic species. The specific differences of the British species of wasps require a more minute investigation than has yet been given to them. This can only be done by studying the habits of the different species, in conjunction with individuals of the different sexes from the nest of each. Thirty years ago, the necessity for such an inquiry was pointed out by Latreille, who added, "Utinam exurgat alius Kirby qui hanc familiam elucubret." (*Gen. Crust.* vol. iv. p. 143.) But the wasps still remain in as great or greater confusion than they were at that period.

The common British species, V. vulgaris, makes its nest in banks,

&c., underground.* Another species, closely allied to it (V. media *Latr.*), intermediate in size between it and V. crabro, forms a similar nest, but which it attaches to the branches of trees. Dr. Leach (*Zool. Misc.* vol. i. pl. 50.) has described and figured a species under the name of V. Britannica, which ordinarily suspends its nest from trees, especially from pines, varying from the size of a pear to a foot in diameter. The female which has survived the winter makes a small nest, in which a brood of neuters are produced, the *female closing*† the mouth of the cells when the larvæ are full grown. This brood, when arrived at perfection, assist their parent in constructing a *new* and much larger nest. The Rev. E. Bigge, however, considers that the latter statement is not correct; and I am inclined to think that the *larvæ* close the mouth of their cells, especially as Réaumur frequently saw the larvæ in the act of spinning the covering. Latreille describes the nest of V. holsatica *Fab.* as being of a very slender papyritious texture, scarcely two inches long, and almost globular in form, with one end, where is the aperture, truncated. Its envelope is composed of three pieces, of which the basal one resembles the cup of the acorn. One of these nests was found in a bee-hive, another in an empty room. (Latr., in *Ann. du Mus.* tom. i. p. 289.) Réaumur figures a nest, nearly agreeing with this description, attached to a

* Such is the ordinary habitat of the species regarded in this country and France as the V. vulgaris of Linnæus; but that author says, "Habitat sub tectis" (*Syst. Nat.* p. 949.); and De Geer's nest (tom. ii. p. 766. pl. 26, 27. fig. 1.) was from the wooden rafters of a house. The Rev. A. Matthews showed me a very large nest in such a situation, at Weston, Oxfordshire; and I can perceive no difference between the neuters of it and of the underground nest, in my figure 88. 17. The Rev. E. Bigge has endeavoured to clear up the differences between this insect and the tree wasp; but he has fallen into many errors. Thus, he considers the Linnæan V. vulgaris to be the tree wasp, which it certainly is not, because Linnæus says, "Scutello quadrimaculato, abdominis incisuris punctis nigris distinctis," which Mr. Bigge even states is not the case in the tree wasp. He also considers the insect now regarded as the V. vulgaris (the common earth wasp), as the Vespa gallica *Linn.*, which it certainly is not; the latter being decidedly a Polistes, as I can assert, having captured specimens in France exactly agreeing with the Linnæan description. Again, he states that the habits of the tree wasp had been fully described by De Geer; but this is evidently not correct, in consequence of the situation in which De Geer's nest was found. I hesitate, however, in regarding it as identical with the ground wasp of Réaumur, especially in consequence of the difference in the sexual organs of the male, a character which Audouin has proved to be of great specific value amongst the humble bees.

† J. W. Bond (*Entomol. Mag.* No. 18. p. 224.), in like manner, states that the full grown larva is covered in *by the working wasps.*

branch (*Mém.* tom. vi. p. 19. fig. 1, 2.); and Kirby and Spence describe another (vol. i. p. 510.); a correspondent of the *Magazine of Natural History* has figured another, which was found attached to a reed inside the roof of a barn (No. 11. January 1830). A similar nest is represented by Knapp (*Journal of Naturalist*, p. 333.), which he gives as a distinct species, under the name of V. campanaria. Shaw, also (in *Nat. Miscell.* pl. 603. vol. xv.), has figured the nest of the "campanular wasp." I have figured one of these nests in a still more immature state (*Ent. Text Book*, p. 389.); in which the saucer-like cap and half of the envelope only had been completed, leaving the cells exposed. The Rev. E. Bigge not only regards these various nests as those of the tree wasp (V. Britannica *Leach*), in a more or less forward state, but also infers that our species is identical with the American tree wasps mentioned by Shaw, who evidently refers the nest figured to Réaumur's pl. 22. I am, however, inclined, on the other hand, to consider that there are several distinct species amongst these tree wasps, judging from the strong variations exhibited by numerous specimens in my collection.

The hornet (V. Crabro) builds its nest in decaying hollow trees, under the eaves of barns, &c.; it is composed of coarser materials than that of V. vulgaris, Réaumur asserting that it uses the bark of living trees, but Kirby and Spence say decayed wood. If the hole in the tree be not sufficiently large, they enlarge it, gnawing the sides of the interior. The antennæ of the males (*fig.* 87. 18.) are curiously notched on the outside. An abstract only of the elaborate memoir of Strauss, above referred to, has yet been published. He has described 267 solid pieces and 258 muscles in this insect.

M. St. Hilaire discovered in Brazil a species of this family (Polistes Licheguana), which makes an abundant supply of honey; which, like common honey, is occasionally poisonous, owing to the peculiar plants frequented by the insects. (Latreille, in *Mém. du Mus.* tom. xi.)

Epipone morio *Fab.* (Vespa Tatua *Cuvier, Bull. Soc. Philomat.* No. 8.) has the basal segment of the abdomen narrowed into a slender peduncle, like an Eumenes; its nest is in the form of a truncated cone, with the bottom flat. This species inhabits Cayenne.

Another species (Chartergus *St. F.*, nidulans *Fab.*) suspends its nest (which I have received from Demerara) by a ring from the topmost branches of the trees, so as to swing backwards and forwards with the

wind, and to be out of the reach of monkeys. It is in the shape of a truncated cone, and is composed of a very fine substance, exactly like card-board. The combs, which increase in number with the increasing population (the nest sometimes attaining a very large size), are circular, but convex on the under side, with a central aperture for the ingress and egress of the inhabitants; they are attached to the general envelope through their entire circumference; the bottom layer, so long as it serves as the bottom of the nest, is smooth; but when a fresh layer of cells is required, these are built upon the under side of this bottom, with their open ends directed downwards, and a fresh bottom is then added, the central orifice serving to allow a passage through the several layers of combs.

Réaumur has described and figured numerous varieties of these card nests in the 6th volume of his *Mémoires*. I have seen some other varieties, which remain undescribed in the national museums of London, Paris *, and Berlin. One of these is of a large size, and has the outer envelope of the nest covered with small conical prominences. Another nest, lately received by the Zoological Society of London from Ceylon, is not less than six feet in length, and has been built inside an immense palm leaf.

A species of these insects, inhabiting New Spain and the West Indian Islands, has received the name of Vespa vegetans, from having been frequently observed to be infested by a parasitic plant, resembling a coral branch (probably a species of Clavaria), which arises from the segments of the abdomen, or other parts of the body. It is ordinarily upon dead specimens that this occurs; but the plant has been observed to germinate in the larvæ. Indeed, in *Der Naturforscher* (No. 4. tab. 4.), the wasps themselves are represented as flying around a tree, with the vegetating matter growing out of the abdomen. (See *Hist. of Ins., Fam. Library*, vol. ii. p. 296.; *Trans. Ent. Soc.* vol. i. p. lxvi.; *Annales Sci. Nat.* July 1829, in which a species of Sphæria was observed to have infested an entire nest of wasps in Guadaloupe.) Various absurd speculations have been made upon the nature and growth of this plant, which is, however, evidently analogous to the plant (Botrytis Bassiana) which produces the fatal disease in silkworms termed muscardine.

* One specimen in the Jardin des Plantes, about eight inches in diameter, appears to be covered with a thick layer of pottery, rather than papyritious matter, as though formed of earth.

The species of the genus Polistes do not enclose their nests in a general envelope, but leave the cells exposed, attaching them to stems of plants, walls, &c., sideways, so that a moderate-sized nest has, at a distance, somewhat the appearance of a full-blown flower. (Réaumur, *Mémoires*, tom. vi. pl. 19. and 25.; Swammerdam, *Book of Nature*, pl. 26.; Rösel, *Abhandl. Ins.* vol. ii. Bomb. et Vesp. tab. 7.; *Turin Trans.* vol. xxii. Polistes italicus.)

Fig. 87. 19. represents Polistes gallica, stationed upon a very small nest. This, and some other nests of the same species, which I brought to England from Paris, afforded me an opportunity for observing the habits of the species (especially with reference to their flight, and departure from and return to the nest), of which I have read the particulars in a paper before the Entomological Society. M. V. Audouin has observed that the spiracles of these larvæ, owing to the dilated form of the front of the body, are placed only upon the meso- and metathoracic and first abdominal segment.

St. Fargeau states, that he has often found in the nests of Polistes gallica cells filled with honey, which he had tasted without experiencing any ill effects.

Polistes macaensis is a very common Chinese species, and is frequently represented in the drawings on rice-paper sent to this country, together with its nest, which is attached to the twigs of trees, and is composed of cells without any covering.

The second subsection of the Hymenoptera aculeata comprises the very extensive and interesting families of bees, which, from their peculiar construction and economy, may be considered as the types of the order, and, consequently, as the farthest removed from any of the other orders of insects.

As a group, they have been termed by Latreille MELLIFERA * (honey-gatherers), or ANTHOPHILA (lovers of flowers).

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These insects, which in the system of Linnæus formed the single genus Apis, are characterised by having the basal joint of the posterior tarsi dilated into an oblong or subtriangular plate (Planta *Kirby*) (*fig.* 90. 7., 92. 10. 19, 20.), which is generally hirsute on the inside, and provided with instruments for collecting and carrying pollen. In some species, however, which are parasitic and solitary, this joint is simple, but of the same form (*fig.* 90. 19. 21.); the jaws are strong, these organs being ordinarily employed in the economy of the different species, and consequently being varied accordingly; the maxillæ and labium are elongated, and often transformed into a proboscis capable of being folded up several times beneath the head (see *fig.* 89.), the labium being pilose at the extremity; each of the four anterior tibiæ has a single apical spur, and each of the two posterior, a pair, except in the genus Apis.

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Marschall de Beberstein. Apis eriophora, Caucasus, in Mém. Moscow, tom. ii. 1809.

Westwood, in Trans. Ent. Soc. vol. ii. p. 112. (g. Mesotrichia.)

Fabricius, Savigny (Egypte), *Brullé* (Morea), *Perty* (Brazil), *Coquebert, Panzer, Christius, Illiger, Rossi, Spinola, Jurine, Guérin, Curtis, Griffith* (An. K.).

The neuration of the wings, which in other groups of Hymenoptera is of essential importance in generic distribution, here becomes of minor consideration, from the little variation in this character; hence the arrangement of Jurine, founded thereon, is very imperfect.

The larvæ feed exclusively upon pollen or honey. Some of the species live in society, residing in dwellings of a beautiful construction, the work of the females and neuters, or of the latter alone; the larvæ being in such cases separately enclosed in hexagonal cells, and attended and supplied with food by the females and neuters: others, however, are solitary in their habits, without any neuters; the females building nests, generally composed of a series of cylindrical cells, for the reception both of the eggs and a supply of pollen paste sufficient for the support of the grubs when hatched, a single larva occupying each cell: others, again, are solitary, but do not build nests, depositing their eggs, cuckoo-like, in the already provisioned cells of other bees; so that, when the progeny of the latter are hatched, they are either starved to death in consequence of the grub of the former devouring all the provisions (being most probably first hatched), or are even perhaps devoured by the former.* The perfect insects feed only upon the nectar of flowers.

The larva in this section is a whitish, short, thick, and fleshy grub or maggot, having a wrinkled body, somewhat pointed at each end, and generally observed in a curved position (*fig.* 90. 9. larva of Colletes; 91. 15. ditto of Anthidium). It is entirely destitute of feet. The head (*fig.* 90. 10. head of larva of Colletes seen in front; 11. sideways; 91. 16. head of larva of Anthidium seen in front, 91. 17. ditto sideways.) is small, and placed low upon the first segment of the body; it is smooth on the upper part, having a minute conical tubercle on each side, which seems to be articulated near the base and tip (*fig.* 91. 18.). Those two parts were considered by Swammerdam and Walckenaer as the rudimental eyes of the perfect insect; but from their structure it is evident that they must rather represent the antennæ. Below these is to be observed a small transverse lip, answering to the upper lip of the perfect insect; and below this is a pair of horny jaws (*fig.* 91. 16, 17. md), small, having a transverse movement, and shutting under the

* The latter opinion has need of confirmation. In the burrowing Fossores, the parasites doubtless devour the larvæ of the founder of the nest, the latter being also *carnivorous*; but as the larvæ of the working bees are *pollinivorous*, it is contrary to analogy that their parasites should be otherwise than pollinivorous.

upper lip: these jaws are kept by the grub in continual motion when it eats; and it is by their assistance that it gnaws and divides the balls of pollen paste, or other matters which serve for its food. In the larva of Anthidium manicatum these jaws (*fig.* 91. 19.) have three teeth; but in that of Colletes succintus they are acute and entire (*fig.* 90. 12.), thus somewhat resembling the jaws of the perfect insect. Beneath these jaws, and reaching to the sides of the head, are a pair of fleshy organs, which appear to be soldered to the head, having a fine style at the extremity of each. These evidently, from their situation and length, represent the maxillæ of the future bee; and below these is another fleshy, rounded, and somewhat prominent organ (*fig.* 91. 16.), having at its anterior part a transverse corneous line, and a minute fleshy nipple, whence the material is discharged which is employed by the larva for spinning its cocoon, this part is the rudiment of the lower lip. The body, excluding the head and including the anal segment, is composed of fourteen articulations, of which the second and nine following bear a pair of lateral spiracles, beneath which, and forming, as it were, the union between the dorsal and ventral parts of the body, is a series of lateral, raised, fleshy tubercles, which (together with the jaws) are employed by the larva as organs of locomotion in its very limited movements.

Swammerdam (*Book of Nature*, pl. 23. and 24.), Schäffer (*Abhandlungen*, vol. ii. tab. 1. and 5.), Réaumur (tom. v. and vi.), De Geer (tom. ii.), Guilding (*Linn. Trans.* vol. xiv.), Walckenaer (*Mém. Halictus*), Ratzeburg (*Nova Acta Berl.* vol. xvi. tab. 9.), &c., have given descriptions and figures of the structure of the larvæ of various bees, which do not exhibit any material diversity. According to Schäffer, the structure of the mouth of the larva differs in the sexes. Swammerdam appears to have fallen into some errors as to the same organs, and the portions of the mouth of the perfect insect represented thereby. A wide field remains unexplored with respect to this branch of the science.

The pupa (*fig.* 91. 22. pupa of Apis mellifica ♂), whether enclosed or not in a cocoon spun by the larva, is at first soft, but exhibits all the limbs of the future bee, enclosed in separate cases, and laying along the breast. By degrees it acquires greater consistence, and exhibits all the colours of the perfect insect. And it is to be observed, that the exuviæ both of the larva and pupa are so exceedingly delicate, as to have escaped the notice of some authors, who have asserted that

they do not cast their skins. That this, however, is not the case, is evident, not only from analogy, but from an interesting specimen of Colletes succinctus in my collection, which I have represented in *fig.* 90. 13., and in which the pupa is in the act of bursting through the dorsal skin of the larva; and it would seem as if the insect had not sufficient strength to enable it to make its escape, but that it remained alive in that position until the enclosed parts of the perfect insect had attained their ordinary colours, the thin skin with which they are covered being also scaled off in several places.

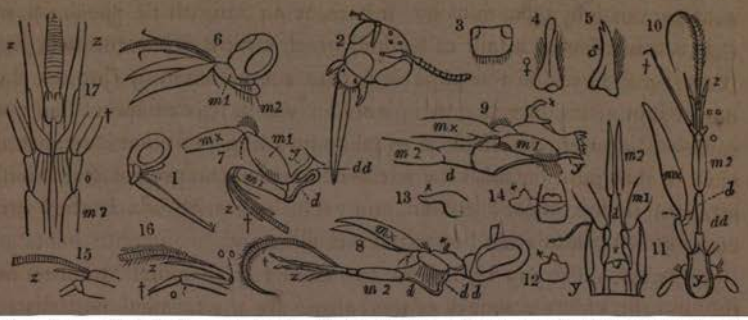
Probably, no group of insects has attracted so much attention as the present, either amongst general observers or professed naturalists; hence we find that the bees have afforded subjects for some of the most interesting memoirs which have hitherto been produced upon the insect tribes. Réaumur, De Geer, Huber, Latreille, and Kirby, have especially devoted themselves to the investigation of the habits and structure of these insects. The *Monographia Apum Angliæ* of the last-named author may be cited as a model of a complete monograph. In it, and other more recent publications, about 250 species of bees found in Great Britain are enumerated.

The classification of the Mellifera depends considerably upon the variations in the structure of the mouth; hence, and because the oral apparatus of the bee is perhaps one of the most interesting and complicated pieces of insect mechanism, I may perhaps be allowed to give a somewhat more extended notice of it*, selecting for illustration one of those species in which it is most fully developed, namely, the Anthophora retusa, and illustrating it minutely in various positions.† If

* This account of the mouth of Anthophora retusa, and the subsequent observations upon the nature of the parasitic connection existing amongst certain bees, form the subject of a memoir read by me at the Entomological Society, on the 1st of December, 1834.

† *Fig.* 89. 1. represents the head of A. retusa, laterally, with the mandibles closing upon the extremity of the labrum, and the maxillæ and labium bent beneath the breast, as in inaction; *fig.* 89. 2. the head in front, with the latter organs in the act of being brought forwards; *fig.* 89. 3. the labrum detached; *fig.* 89. 4. mandible of the female; *fig.* 89. 5. ditto of the male; *fig.* 89. 6. profile of the head, with the labium and maxillæ partially unfolded and separated, showing the tubular mentum (m 2.) partially sheathed by the basal part of the maxillæ (m 1.); *fig.* 89. 7. shows the basal parts of these organs still more unfolded, to exhibit the manner in which the fulcrum, *K.* (d), and the cardines, *K.* (d d), shut together, so as to lie between the lora, *K.* (y); *fig.* 89. 8. is a lateral view of the head, and lower parts of the mouth extended (the labrum and mandibles being removed); m x

Fig. 89.



the face of this insect, or in fact of any other species be examined, when at rest, there will only be observed a square or other shaped deflexed lip, over or beneath the extremity of which a pair of horny jaws will be seen. If, however, the under side of the head of the above-mentioned insect be examined, a long slender horny organ (*fig.* 89. 1.) is perceived, which, in its unfolded and extended state, constitutes the tongue of the bee. This organ at first appears to consist but of a single piece, but it is in fact composed of two separate parts, closely uniting along the centre in a straight line (*fig.* 89. 2.). Presently we see the jaws opened, the labrum raised, and this slender

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the terminal lobe of the maxillæ; d d one of the cardines, d the fulcrum, m 2. the tubular mentum (tubus *K.*); z the paraglossæ (laciniæ interiores *K.*); and † the 4-jointed labial palpi (laciniæ exteriores *K.*); x the epipharynx or epiglottis of Savigny, beneath the labrum; *fig.* 89. 19. the basal portion of the same apparatus still more fully extended; *fig.* 89. 10. the same organs seen from beneath, o being the extremity of the mentum, and o o the base of the labium, the intervening space being occupied by the basal dilated muscular portion of the paraglossæ; y the lora *K.*, or strong muscle whereby the maxilla is protruded; *fig.* 89. 11. the basal portion of the same organs seen from above, to show the situation of the epipharynx (x), of which the extremity is recurved, as in *fig.* 89. 9. x; *fig.* 89. 12. the epipharynx removed, and *fig.* 89. 13. the same laterally, both with the front turned down; *fig.* 89. 14. the epipharynx (dotted) separated from the pharyngeal tube, in order to show the internal valve (hypopharynx *Savigny*); *fig.* 89. 15. the extremity of the tubular mentum, with the basal portion of the labium and its laciniæ withdrawn into the tube as at rest; *fig.* 89. 16. a section of the same, to show the manner in which the folding of such basal parts is effected; *fig.* 89. 17. the extremity of the mentum (m 2.), and the base of the labium and its laciniæ (z) and palpi (†) fully protruded, showing the strong muscles at the base of the laciniæ.

Observ. — The same letters are applied to the same organs throughout all these figures.

part gradually brought from beneath the breast, by means of a joint at that part which appears to be its base, lying beneath the jaws, where it is furnished with a pair of jointed palpi, until it is stretched out in front like the beak of a bird. This part now opens laterally (*fig.* 89. 6.), and exhibits not only the two pieces of which it is composed (m 1.), but also three organs often of equal length, hitherto concealed within it as by a sheath, namely, a delicate central one, transversely striated, and two lateral ones, flattened, and very slender, with a central rib, and with an articulation beyond the middle, and two minute joints at the tip (*fig.* 89. 10. †). The two horny pieces first noticed as forming the external sheath of the tongue are the terminal portions of the maxillæ, and the feelers at their elbowed base are the maxillary palpi; the central striated organ is the labium, and the two lateral articulated ones are the labial palpi. We next observe that the annulated labium, without any apparent motionof the other parts of the mouth, is suddenly thrown out to nearly double its former length (as in *fig.* 89. 8.): this is effected in the following manner; if, whilst remaining in this position, we examine the under side of this apparatus, we perceive that the base of the central part arises not from the head itself, but from a slender horny tubular piece, which is the mentum (*fig.* 89. 6, 7. 10., m 2.). On each side of this central part, two slender filaments* (paraglossæ, z) moreover exist, which, as well as the base of the labium itself, are withdrawn into the extremity of the tubular mentum (as in *fig.* 89. 15, 16.), so that the tips alone of the paraglossæ are visible (16. z). As, however, the muscles at the base of these organs are very strong (*fig.* 89. 17.), the insect is enabled, at will, to throw out the labium and its paraglossæ with much force to their greatest elongation (as in *fig.* 89. 8. 10. 17.). Another peculiarity is at that time observable: the central portion, although striated, does not at first exhibit any remarkable hairiness; but no sooner is the labium thus thrown out and retained in its situation, as it were, by a sort of catch or fastening, than the central part becomes distended, the muscles of each ring of which it is composed being brought into action, by which means the erection of a whorl of hairs upon each ring at *right angles* (which had previously laid *along* the organ) is effected: this is especially the case near the extremity of the tongue. I have often caused this erection of hairs artificially by

* Analogous to the lateral labial lobes of Tenthredo (fig. 69. 9.).

forcibly pulling out portions of the labium as far as possible.* The labial palpi being attached by a muscle (*fig.* 89. 17. o) to the base of the labium, also undergo a similar withdrawal and protrusion, but to a much less extent. The tubular mentum (m. 2.) extends to the back of the head, and is defended on each side by the basal portion of the maxillæ (m.1. as in *fig.* 89. 6, 7.); but if a pin be applied between this unitedapparatus and the head, two other elbows will be found connecting the tube and the maxillæ with the head, and it is not until these elbows are extended in nearly a straight line, that the mouth is stretched out to its fullest extent. The elevated horny ridge extending from the base of the tubular mentum to the elbow nearest the head (d), is the fulcrum of Mr. Kirby's monograph; and the diverging horny ridges (dd) connecting the base of this fulcrum with the maxillæ, are the cardines of Mr. Kirby. In the *Introduction to Entomology* (vol. iii. p. 356. and note, and p. 359. note) this fulcrum is called the true mentum, the tube being regarded as the labium, and the striated piece as the lingua; the reasons alleged for this nomenclature being, that the situation of the fulcrum between the hinges and base of the maxillæ indicates it as being the real analogue of the mentum; whilst the terminal striated portion, being employed to lap honey, should be regarded as a tongue rather than a lip (labium). If we look, however, at the place of insertion of the labial palpi, between the tube and the striated part (the typical position of these organs being between the mentum and labium); if we observe that when at rest (*fig.* 89. 6.), the tube rests between the basal portion of the maxillæ (which is the typical position of the mentum); and if we recollect that the loræ, cardines, and fulcrum of Mr. Kirby are organs bestowed upon the bees for the necessary elongation of the oral apparatus, we can but regard the tube of Mr. Kirby as the true mentum, and the tongue as the labium. I shall therefore adopt the nomenclature of Latreille, Savigny, &c. for these organs. The fulcrum on its upper side (*fig.* 89. 11.) exhibits a narrow gutter (d) enclosed above at its junction with the head, by a membrane produced in front (x), so as to

* I am not aware that these peculiarities have been so minutely described by any preceding author, and have been the more anxious to explain the nature and cause of the extension and dilatation of the labium in Anthophora (which, in fact, is its more common and natural position when in action), because in several works, including Mr. Curtis's *British Entomology*, it is represented in an unfolded, but not in a dilated state, not being longer than the labial palpi, which might probably induce the idea that these figures were not conformable with nature.

form a tube, which is the pharynx, the extremity of this membrane being deflexed (*fig.* 89. 12, 13. x): if this, however, be removed (*fig.* 89. 14.), we perceive a beautifully delicate, erect, membranous valve which entirely closes the entrance into the œsophagus. The ease with which this complex machinery, which when at rest presents not fewer than four different foldings, is employed, is surprising. It is also to be observed that when folded up it is almost difficult to conceive where it can be placed so as to permit so little of it to be seen. This, however, is to be explained by the under side of the head being hollowed out for its reception.

Another character of considerable importance in the classification of the bees is one which, from its immediate connexion with their economy, will not be considered less deserving of a detailed account. M. le Comte de St. Fargeau, following up the views of Latreille, has given an interesting notice of the organs employed by various bees for the collection of pollen, in the tenth volume of the *Encyclopédie Méthodique.* The larvæ of all the Mellifera feed either upon paste formed of honey and pollen, or upon honey alone; but as the females of nearly one third of the modern genera of bees do not possess organs enabling them to provide this paste (*fig.* 90. 19. hind leg of Sphecodes; 21. ditto of Hylæus, destitute of polliniferous organs), they are compelled to deposit their eggs in the nests of other bees. These organs are of two kinds: the first consist of naked portions of the body, either slightly excavated or flat, with the margins fringed with hairs; this instrument has been termed "la palette," which may be englished the pollen plate. It exists on the outside of the hind tibiæ and basal joint of the tarsi of the neuter hive and humble bees (*fig.* 92. 19.), which are rather hollowed out, and in which species it is employed to carry pollen grains which have been saturated with honey. In other bees belonging to both the families into which the Mellifera are divisible, such as Dasypoda, Andrena, Colletes, Halictus, and Panurgus, it exists upon each side of the metathorax, and the corresponding surface of the two posterior thighs (*fig.* 90. 7.), and is employed for the purpose of carrying plain grains of pollen, its sides being guarded by incurved hairs. The other instruments consist of bundles of hairs, whence they have been termed the scopa or scopula by Mr. Kirby, "la brosse" by the French, and which we may call the pollen brushes (*fig.* 90. 7., and 91. 8.). All bees, indeed, possess brushes of hairs, the queen of the hive bee being the only known exception; but these

ordinary brushes, or, as we may term them, brushlets in all male bees, and in the females of the parasitic species, only enable the insects to clear themselves from the pollen with which the body has been powdered in the flowers which they have been plundering: in the females of the working bees, however, they serve to collect the pollen to certain parts of the body more thickly clothed with hairs, and which are the real pollen brushes. In the social bees these are placed (in addition to the external pollen plate) on the inside of the posterior tibiæ and tarsi (*fig.* 92. 20.). In other working bees, Eucera, Systropha, Anthophora, Xylocopa, &c., the pollen brush is placed on the outside of the two posterior tibiæ and tarsi (*fig.* 91. 8.); whilst in others (Anthidium, Osmia, Megachile, &c.) the under side of the abdomen is entirely covered by it (*fig.* 91. 14.).

From these considerations, M. St. Fargeau is induced to propose the division of each of the two families of the Mellifera into two groups, under the names of "parasites" and "récoltantes," subdividing the latter into various minor divisions from the situation of the pollen plates and brushes. M. Latreille, however, has not adopted this mode of arrangement. Indeed it is to be observed that the variation in the structure of the species, thus varying in their habits, does not seem to warrant the establishment of them into separate families. This circumstance appears naturally dependent upon two considerations: 1st, it is essential that the parasite in its perfect state should possess a certain resemblance to the animal in the nest of which it deposits its eggs, so as to deceive the latter and its associates*; and 2nd, the nature of the food of both being similar, the variation in structure is much less striking than if the parasite were carnivorous, as the Ichneumonidæ, and the animal attacked (as the caterpillars of Lepidoptera, &c.) herbivorous. The parasitic connexion indeed goes no further than this, viz. that the larva of the parasite eats up the food of its fosterer, and so starves it to death; the larvæ of both are therefore pollinivorous, and the differences which will naturally be most striking, will consequently be found in those organs which are

* So closely is this resemblance carried in the parasitic Bombi, that the propriety of their generic separation from the working humble bees has even been questioned. In like manner, the Dipterous genus Volucella, which is parasitic upon bees, so closely resembles them in general appearance, that it requires some little entomological skill to distinguish them from the humble bees: other instances to the same effect might be adduced.

employed in the construction and provisioning of the nest of the working species, and which we may therefore expect to find in a less developed state than in those species which, from being parasitic, do not require their full development. Hence it is that we find the general structure of the parasite bee closely resembling that of the bee, at the expense of whose young its own are destined to be nourished; and hence, if we regard Bombus and Psithyrus of St. Fargeau, Aglae and Euglossa, Melecta and Anthophora, or Sphecodes and Halictus, with reference to their general structure, they will be found most intimately allied; whilst if, on the other hand, we regard such portion of their economy as is connected with the formation and provisioning of their nests, it will be requisite to place them in different divisions. If we observe, however, the great variation existing amongst bees in this portion of their economy, it is evident that this cannot be regarded as a normal or typical character, and that a distribution founded thereupon would necessarily be unnatural. The arguments which I have already employed in pages 86., 186., and 238. upon this subject, in relation to the sand wasps and wasps, are of course equally applicable to this tribe of insects.

I will therefore now shortly notice those arrangements which have been made by authors, and which are based upon structural variations. Réaumur, followed by De Geer and other early authors, separated the bees into two primary divisions, under the names of "Abeille" and "Pro-abeille." To these, other generic groups were added by Scopoli and Fabricius, which Mr. Kirby, in his celebrated monograph upon the English bees, published in 1802, reduced again to two, under the names of Melitta and Apis; the characters forming the most striking distinction between them being furnished by the tongue, which organ in the first is short, flattish, usually acute, with a lateral auricle, and not inflected (*fig.* 90. 3, 4. 20.), and being in the latter (containing the true bees) elongate, slender, cylindrical, and folded backwards towards the breast (*fig.* 89. 7. and 92. 16.). In the same year, Latreille, in the memoirs appended to his *Natural History of Ants*, and in his *Histoire Naturelle, &c.*, divided the bees into two families: 1. Andrenetæ (named after the extensive Fabrician genus Andrena, and corresponding with Mr. Kirby's genus Melitta and Réaumur's Pro-abeille); and 2. Apiariæ (corresponding with Mr. Kirby's Apis and Réaumur's Abeille): and Latreille's names, altered by English entomologists in their terminations into the family names of

Andrenidæ and Apidæ*, have been adopted by the generality of writers for the two primary divisions of the bees.

In the first of these families, ANDRENIDÆ † (*fig.* 90. 1. Andrena nigro-ænea ♀), the mentum is elongated, the labium at its extremity

Fig. 90.

small, and either spear-shaped (*fig.* 90. 2. head of Andrena with the organs unextended; *fig.* 90. 3. the same with the parts fully extended) or cordate (*fig.* 90. 20. labium of Colletes), with a small ear-shaped lobe on each side, and being either straight or very slightly deflexed in some (*fig.* 90. 4. apex of labium of Andrena, not folded backwards), and reflexed in others, and considerably shorter than the tubular mentum; the labium and terminal maxillary lobes not forming an elongated proboscis. The palpi are of the ordinary shape, the labial

* As the preceding section, Prædones, is divided into subsections, named from some peculiarity of structure or habits, which are again divided into families, it would be more uniform to consider the two divisions of the section Mellifera as subsections, instead of families, which might be named, from the different degrees of development of the mouth, Brachyglossata or Brevilingues, and Macroglossata or Longilingues; and these, again, might be divided into families, as the Megachilidæ, Anthophoridæ, &c. I confess, however, that I prefer retaining the old Linnæan and Fabrician names to designate the groups which were originally comprised therein.

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† BIBLIOGR. REFER. TO THE ANDRENIDÆ.

Walckenaer. Mémoire pour servir à l'Hist. Nat. g. Halictus. 8vo. Paris, 1817.
Imhoff. Description of Andrenidæ, in Isis. 1832.
Dufour, in Ann. Soc. Ent. France, 1838, p. 281. (Andrena lagopus, Megilla.)
Wesmael. Observ. sur les Espèces du g. Sphecodes, Bruxelles, 8vo.

ones being 4-jointed, and resembling the maxillary, which have always six joints. The mandibles are simple, or terminated by one or two notches (*fig.* 90. 5. mand. of A. armata ♂). The antennæ are elbowed (*fig.* 90. 6. antenna of Andrena ♂); the hind legs (*fig.* 90. 7. hind leg ♀, 8. ditto ♂ Andrena) are generally completely clothed with hairs; the trochanters and femora in the females being pollinigerous; the basal joint of the posterior tarsi is never externally dilated into an angle, and the second joint of the tarsi arises from the centre of the lower edge of the preceding joint.

These insects are all solitary, each species consisting only of males and females. The latter collect pollen from the stamens of flowers, rather by means of the general hirsuties of the body than with the posterior tarsi. This they form, by the addition of a little honey, into a paste for the food of their progeny. They burrow in the ground, often to a considerable depth, in sandy situations; sometimes even upon foot-paths, especially if exposed to the sun. At the foot of these burrows they deposit an egg in the midst of a supply of this paste sufficient for the entire consumption of the future grub, and which is then covered up: they thus proceed, cell after cell, each being of the width of the burrow, closing up the hole at the top with earth, to prevent the attacks of parasites, which, however, often succeed in entering the hole, and depositing their eggs in the cells. Some species, however, are parasites upon the others, the nature of whose economy I have already detailed.

In the structure of the mouth, some of these insects are nearly related to certain burrowing wasps, as Crabro, Philanthus, &c.: with these, therefore (forming a first division, which may be termed Obtusilingues), the arrangement of the bees is commenced; and in which the central portion of the labium is obtuse, being either transverse or heart-shaped, and very short (*fig.* 90. 20. labrum of Colletes). This division comprises only two genera, both of which are British.

The species of Hylæus (which as a genus has been greatly confused by Fabricius) have naked bodies, and are consequently destitute of apparatus for carrying pollen, and are stated by St. Fargeau (*Enc. Méth.* tom. x. p. 213.) to be parasitic upon other Mellifera (*fig.* 90. 21. hind leg ♀). They are generally found in the flowers of various species of Reseda; I have also observed them repeatedly in those of the onion. They emit, when handled, a strong, yet agreeable odour, resembling the scent of balm, or rather Dracocephalum Moldavicum.

One species, H. dilatatus *K.*, has the basal joint of the antennæ greatly dilated.

The species of Colletes, of which the type is Réaumur's "Abeille dont le nid est fait d'espèces de membranes soyeuses" (*Mém.* tom. vi. m. 5.), are workers, having hairy bodies for the collection of pollen. They nidificate in the earth and the softer parts of walls: each nest is cylindrical, consisting of from two to four cells placed end to end, the bottom of one fitting into the mouth of that beneath it; each cell is about one third of an inch long, and one sixth of an inch broad, and is composed of several layers of a very thin and transparent membrane (how prepared Réaumur could not ascertain); in each cell is deposited an egg and a quantity of pollen paste, destined for the food of the larva when hatched. The history of these insects is contained in Réaumur's fifth memoir of his sixth volume. The perfect insects are generally found towards the end of the summer. I have observed that they frequent the flowers of the common ragwort.

The typical species was first noticed in Grew's *Rarities*, the nests having been found by that author in the middle of the pith of an old elder branch. I have found it burrowing gregariously, in considerable numbers, in sunny sand-banks at Coombe Wood, in the month of July; and have succeeded in rearing the bees from the larvæ (*fig.* 90. 9—12.) found in the cells. After the insects have become pupæ, a thin inner lining, of a dark brown colour, is found to have been left by the larvæ, which, as it exhibits, under a high-powered lens, no traces of a thread or silken construction, is most probably composed of hardened pollen paste.

In the second division of the Andrenidæ (which may be termed Acutilingues), the central terminal portion of the labium is acute or lance-shaped (*fig.* 90. 3, 4.); and in some of the latter genera of the division, it nearly approximates in its increased length to the structure of the same organ in some of the Apidæ.

The species of Sphecodes are the only bees in this division which are destitute of pollinigerous organs (*fig.* 90. 14. Sphecodes gibbus ♀, 15. mandible ♂, 16. ditto ♀, 17. antenna ♂, 18. antenna ♀, 19. hind leg ♀). They are generally black, and destitute of hairs, with the abdomen of a shining red colour. According to M. Walckenaer, they are parasitic upon the species of Halictus. Mr. Kirby, however, (citing Réaumur's tom. vi. mém. iv.), states that they make their own nests in the manner of the Halicti; but from the construction of their

legs, it is evident that they cannot be pollinigerous, as indeed Messrs. Serville and St. Fargeau affirm. (*Enc. Méth.* tom. x. p. 447.)

The Halicti consist of some of the smallest indigenous species of bees. In the males, the body is cylindric, and in the females the extremity of the abdomen is marked with a longitudinal channel. Some of the species are metallic in their colours. We are indebted to M. Walckenaer for a very interesting and complete account of the habits of two of the species of this genus, namely, the Halictus terebrator and 4-signatus, which make their burrows in beaten tracks, depositing in the cells with their eggs a small ball of pollen slightly moistened with honey. The burrows are often to be observed in vast numbers, placed close together. See also *Encyclop. Méth.* (tom. x. p. 407.) for further details of the habits of this genus.

The species of the genus Andrena are very numerous, and make their appearance in the early spring and summer months: they have very much the appearance of hive bees (*fig.* 90. 1. Andrena nigro-ænea ♀, 2—8. details). They nidificate under ground in a light soil, forming burrows from five inches to a foot deep; preferring a southern aspect, and removing the earth grain by grain. The diameter is sufficient only to allow the bee to enter and go out; at the foot of this burrow they deposit an egg, placing with it a small mass of pollen paste. The pollen is carried not only upon the pollen plate of the hind leg, but also upon the pollen brush at the base of these legs, and at the sides of the metathorax. When the female has completed the deposition of her eggs, she carefully stops the mouth of the burrow. During the progress of nidification she occasionally takes rest, sitting and sunning herself at the mouth of her cell; her partner wheeling around her in circles of varied diameter, with great velocity. (Réaumur, *Mém.* tom. vi. mém. 4.)

The sexes of many of the species are unknown; this is even the case with And. fulva, the most beautiful and by no means a rare species, and of which the females alone are known. They frequent the blossoms of the gooseberry.

These insects are subject to the attacks of various enemies; amongst these, the most striking are the species of Stylops, and the curious little insect which has been regarded as the larva of the Meloe. Dr. Klug has likewise published an account of another parasite * upon Andrena in *Der Gesellschaft Naturforschen der Freunde zu Berlin Magazin*, vol. iv.

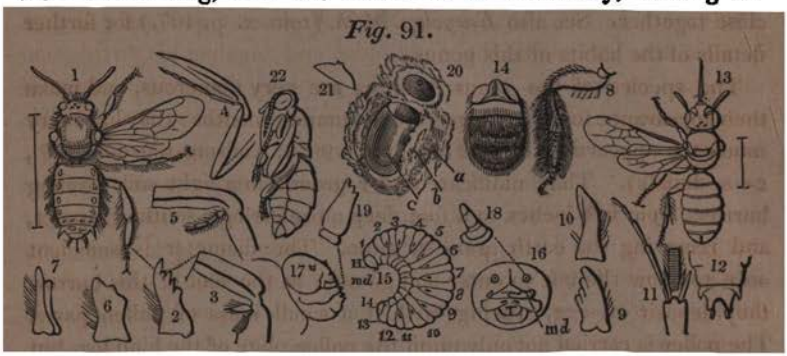
* Braula cæca (*Nitzsch*) is another singular parasitic genus found upon bees.

In Dasypoda the sexes vary so much in appearance, that they have been regarded as distinct species. Mr. Kirby states respecting the only British species, that its habits are similar to those of Andrena, forming burrows, at the mouth of which the female sits enjoying the sunshine, the male circling round her.

The exotic genus Nomia is remarkable for the curious manner in which the legs of the males are dilated, curved, and spined.

The insects composing the second family of the bees, APIDÆ, have the mentum long, with the labium at its extremity, forming an

Fig. 91.



elongated slender seta, reflexed when at rest, and as long as, or longer than the mentum, with two small lateral filaments (paraglossæ *Illiger*, auriculæ *Kirby*), and forming with the maxillæ (which are also elbowed and recurved at the place of insertion of the palpi) an elongated proboscis, capable of being porrected in front of the head when in action, or folded up beneath it, and the breast when at rest, in the shape of a flattened Σ (see *fig.* 89.). The palpi, attached at the base of the labium, form two slender flattened filaments often as long as the labium itself, the two basal joints being very long, with the two apical joints minute, and obliquely affixed near the extremity of the second joint*; the maxillary palpi vary in the number of their joints

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Réaumur has figured some other curious parasites in his *Mémoires*, tom. v. pl. 36. f. 1—3.; and tom. vi. pl. 4. f. 13, 14., and pl. v. f. 8, 9.) belonging to the Acaridæ: and see Goeze, in *Der Naturforscher*, st. 14. I have also found a very singular and distinct Anoplurous insect parasitic upon an Andrena.

* In the species nearest allied to the Andrenidæ (Panurgus, Nomada, &c.), the joints of the labial palpi are continuous (*fig.* 91. 11. labium and palpus of Nomada).

from one to six (*fig.* 91. 4. maxilla of Nomada; *fig.* 89. 10. m x, ditto of Anthophora; *fig.* 91. 5. ditto of Osmia; *fig.* 91. 3. ditto of Anthidium). The antennæ are often elbowed, the basal joint being long. The basal joint of the posterior tarsi is often externally dilated, and the second joint in some species arises from the internal angle of the preceding joint (as in *fig.* 92. 20.).

The economy of these species of bees is very different, but may be reduced to three heads, namely, 1st, Social bees; 2d, Solitary working bees; 3d, Cuckoo-like parasitic bees. From the great extent of this family it has become necessary to introduce various subfamilies, &c., for which improvements we are indebted to Kirby and Latreille. The former author, commencing the arrangement with such insects as most nearly resemble the Andrenidæ, and founding his distribution upon various portions of the mouth, proposes the establishment of subdivisions, in which, after the Andreniform species, the parasitic bees succeed, and which are followed by the leaf-cutters and mining bees, and the woolly-legged bees; the series being terminated by the genera Xylocopa, Apis, and Bombus of modern authors. In this arrangement, Mr. Kirby, evidently fearful of placing too great a reliance upon a single character (that of the number of joints in the palpi, of the classification resulting from which he has given a table in his first volume, p. 129.), and influenced by the general appearance of the insects, placed the carpenter bees, Xylocopæ, near to Bombus, between which, however, the relationship, either in structure or economy, is but slight.

In the same year that Mr. Kirby's monograph appeared, Latreille published a memoir upon the distribution of the bees amongst the valuable papers appended to his *History of the Ants*; which distribution was so similar to that of our countryman, that in his next work he thus expressed the lively sentiments resulting from such a coincidence: "Aussi ai-je senti la joie la plus vive de me voir dans un si grand accord avec cet illustre savant; une telle resemblance dans le fruit de nos recherches prouve évidemment que la nature qui est une, a été notre guide." (*Hist. Nat., &c.* tom. iii. p. 370.) In his *Genera Crustaceorum, &c.* (vol. iv. 1809), Latreille, in a note, gave the following series as indicative of the habits of his groups: 1. Solitary Andreniform bees (Systropha, Panurgus): 2. Solitary carpenter bees (Xylocopa, Ceratina, Rophites, Chelostoma, Heriades, Stelis); 3. Solitary leaf-cutter bees (Osmia, Megachile); 4. Solitary wool-

gathering bees (Anthidium); 5. Solitary parasitic bees (Nomada, Pasites, Melecta, &c.); 6. Solitary woolly-legged bees (Eucera, Anthophora, Centris, &c.); 7. Bees temporarily social (Euglossa, Bombus); 8. Bees permanently social (Apis, Melipona, and Trigona). In this work Latreille considers the parasite bees more nearly allied to the woolly-legged ones (by means of Melecta and Anthophora) than to the Andreniform bees (by means of Nomada and Panurgus) as arranged by Mr. Kirby. In effect both these affinities seem equally true, the difficulty as to the arrangement of these parasitic genera in accordance with their real allies, arising from the parasitic nature of the former, and the solution of the question whether their arrangement ought not to be entirely independent of such consideration. In his last general work, the second edition of the *Règne Animal*, Latreille has advantageously reduced the number of primary groups, and divided the family into five sections:—1. Andrenoides (Andrena-like bees, including the first group in his *Genera*, with the addition of Xylocopa); 2. Dasygastres (hairy-bellied bees, including the remainder of the second, and the third and fourth groups); 3. Cuculinæ (cuckoo bees, his fifth group); 4. Scopulipedes (brush-legged bees, his sixth group); 5. Sociales (social bees, containing the two remaining groups of his '*Genera*').

This arrangement I shall adopt with the following slight alterations: the subfamilies Dasygastres and Cuculinæ, being established upon characters arising from their polliniferous or parasitic economy, will (for the reasons already given) require modification, as indeed Latreille himself admits. (*Règne Animal*, tom. v. p. 347.) For the former I therefore propose the name of Longilabres, long-lipped; and the latter, which, however, I would only provisionally retain, I denominate Denudatæ, naked bees; restricting the limits of these groups by the characters which have supplied their altered names. Moreover, the genus Xylocopa appears to me to be much more nearly allied to Anthophora* and Centris, than it is either to Ceratina or Panurgus (as indicated by Latreille), or to Bombus, as insisted upon by Mr. Kirby. If we therefore adopt the following position of these subfamilies, we shall perhaps obtain an arrangement founded upon a greater number

* Since the above was written, I have become acquainted with, and described a remarkable osculant genus, proving this relation (Mesotrichia torrida *Westw.*, in *Trans. Ent. Soc.* vol. ii. pl. 9.).

of affinities, and one which apparently rejects the least number of such relations, than any yet proposed.

1. Subfamily Andrenoides. Panurgus, leading to Nomada in the next subfamily, but rejecting the supposed affinity with Xylocopa.
2. Subfamily Denudatæ, passing to Stelis and Cœlioxys in the next subfamily, but rejecting the affinity of Melecta and Anthophora.
3. Subfamily Longilabres, connected with the next subfamily by Osmia, Macrocera, Eucera, and Ceratina?
4. Subfamily Scopulipedes, passing by means of Epicharis, Lestes, and Xylocopa, to Euglossa and Bombus in the
5. Subfamily Sociales, consisting of the temporarily and permanently social bees.

The first subfamily, ANDRENOIDES, or, as it may be more uniformly termed, PANURGIDES, consists of insects nearly allied to the Andrenidæ in the labium being shorter than the mentum, and in the structure of the labial palpi, which are composed of continuous linear joints (*fig.* 91. 11.), the two basal ones not being so much elongated as in the following subfamilies. The maxillary palpi are 6-jointed (*fig.* 91. 4.); the upper lip is short; and the females are destitute of a pollen brush on the under surface of the abdomen. They are, however, furnished with a pollen plate on each side of the metathorax, and another on the posterior femora: the hind legs have also pollen brushes.

Of the mode of nidification of these insects, nothing is known. The perfect insects belonging to the genus Panurgus, according to Latreille, are attached to semiflosculous flowers: I have observed them revelling in the pollen of a large Anthemis; and so little disturbed were they on my approaching them, that they contented themselves with merely holding up their legs on one side of the body, precisely in the same manner as the humble bees do under similar circumstances.

The insects composing the second subfamily, DENUDATÆ or MELECTIDES (CUCULINÆ *Latr.*) (as well as those of all the following subfamilies of bees), have the labial palpi formed of two very long, flattened, scaly basal joints, and two minute apical ones (*fig.* 89. 10.† and 92. 16.). The abdomen is not provided with a ventral pollen brush, neither do these insects possess any pollen plates, their bodies being

in effect naked, whence they are supposed to be parasites. Some of the species resemble small wasps in their colours, whilst in others some parts of the bodies are clothed with small patches of very short hairs. The mandibles are narrow (*fig.* 91. 10. mandible of Nomada), and either toothless, or armed only with one small tooth. The scutellum is often tuberculated or toothed. From their evidently parasitic habits they have been termed cuckoo-bees.

These insects, from the structure of the tongue and other parts of the mouth, form three sections, of each of which we have a representative genus in England ; Nomada, in its tongue and palpi, nearly approaching Panurgus; Melecta, in the general form of the mouth, being closely allied to Anthophora; and Epeolus, in its exarticulate maxillary palpi resembling Cœlioxys.

The species of Nomada are gaily coloured insects, having much the appearance of small wasps, with which they have been confounded by some authors. They are destitute of hairs, and have no instruments for carrying pollen. Of their precise habits, however, we are without decisive information. They frequent dry sunny banks, flying without any noise ; and it has been considered by many entomologists that they are parasitic upon other bees, and Mr. Shuckard conjectures that they infest not only the nests of several species of Andrena, but also of Eucera.

The type of the genus Melecta is an elegant species, having the margins of the abdomen spotted with white markings. According to Mr. Kirby, both sexes of this insect were found by Mr. Trimmer in the nest of Anthophora retusa, whence, as well as from other circumstances which he mentions, he was induced to consider that it was parasitic upon that insect. I have repeatedly found them in company, and seen the Melecta entering the burrows of the Anthophora. According to Mr. Shuckard, it is parasitic upon Eucera, as well as both the British species of Anthophora. Mr. Newman has, however, considered this difference of connexion as indicating a distinction of species, and has accordingly "made six distinct species out of Melecta punctata." (*Ent. Mag.* No. 10.) We have no decisive information as to the habits of Epeolus.

The third subfamily, LONGILABRES or MEGACHILIDES (Dasygastres *Latr.*), as the former names import, is distinguished by the large oblong form of the upper lip. The mandibles are very strong, and armed with several teeth (*fig.* 91. 2. mandible of Anthidium, 6. ditto

of Osmia ♀). The maxillary palpi are but slightly developed (*fig.* 91. 3.); the labial, on the contrary, are very long, with the two last joints obliquely inserted; and the paraglossæ are minute. In general the wings have only two complete submarginal cells. Cœlioxys and Stelis approach the preceding subfamily in the want of polliniferous organs, and in their naked bodies; but, from the structure of their mouths *, they must be placed in this subfamily. All the other genera are polliniferous, the pollen brush being very large, and covering the under side of the abdomen (*fig.* 91. 14.). They are, however, destitute of pollen plates. From their respective economy, they have been termed mason and upholsterer bees; the former building their nests of fine moistened earth, whilst the upholsterers employ in the construction of their cells portions of leaves, which they have cut from various plants by means of their powerful jaws, which are employed like a pair of scissors.

The males of the genus of Cœlioxys, as Mr. Kirby observes, have only six abdominal segments, instead of the ordinary number seven (*fig.* 91. 12. apex of abdomen of C. conica ♂). Messrs. Serville and St. Fargeau state, that these insects †, as well as the species of Stelis, deposit their eggs in the nests of Anthidium, Megachile, Osmia, and Anthophora.

In the genus Anthidium, the males (*fig.* 91. 1. A. manicatum ♂, 2, 3., 15—21. details and larva, &c. of ditto), are much larger than the females; and the abdomen, which is broad, is armed in the former with lateral and terminal spines; in the other sex it is round and unarmed. These insects frequent various woolly leaved flowers, strip-

* *Fig.* 91. 9. represents one of the mandibles of Stelis: those of Cœlioxys are still more robust, and toothed; thus proving that, although parasites, those organs, which in the working species are used as tools, retain their typical form in the parasite, and do not undergo a modification of form, their *habitudes morales* not being sufficiently strong to necessitate a modification of these organs. This is the only reason I can suggest why these parasites should have jaws shaped like those of the working species upon which they are parasitic.

† Réaumur describes and figures an insect (*Mém.* tom. vi. p. 122. pl. 11. f. 4.) which has all the appearance of a male Cœlioxys (ano 6-dentato), but which he describes as the male of a leaf-cutter bee (Megachile). Linnæus refers this figure to Cœlioxys conica, but Mr. Kirby (M. A. A. 1. 154.) objects to this. I however agree with Linnæus, considering that Réaumur's insect had been reared parasitically in the nest of the Megachile. G. R. Waterhouse has also mentioned some facts to the like effect, having reared a Cœlioxys from cells of Megachile circumcincta, or Osmia atricapilla. (See *Ent. Mag.* vol. iv. p. 498.)

ping off the down with their toothed jaws (*fig.* 91. 2.), for the purpose of forming their nests. Of this an account is given by Mr. Kirby, as well as the description of a nest, supposed to be of this species, found in the key-hole of a garden door. Although holes in trees are the more ordinary situations for their nests, they seem to have an especial liking for the latter locality, since Mr. Anderson, the ingenious curator of the Botanical Garden at Chelsea, has also presented me with a nest found under precisely similar circumstances, and from which I reared specimens of the Anth. manicatum. There were twelve or fifteen cells or cases (*fig.* 91. 20.), consisting externally of a loose covering of white down (20. a), within which was another covering, more compact and smooth on the inside (20. b), and within this was contained an oval cell, of a strong coriaceous texture, and of a chestnut colour (20. c). This latter I consider (as does also Mr. Kirby from subsequent observations (see *Introd. to Ent.* vol. i. p. 439. *note*), to be the cocoon, formed by the larva itself, because some of my woolly cases contained a mass of matter apparently consisting of dried pollen paste, the egg deposited with which had probably on some account proved abortive; and in these there was no oval chestnut-coloured cocoon. It was in February that this nest was discovered, at which period some of the cells were empty, the inhabitants having forced off a circular cap (*fig.* 91. 21.) from the top of the cocoon, and escaped; others, however, contained full-sized grubs. As the other closed cells did not produce insects, I opened them after keeping them more than two years, when I found that each enclosed a dead female insect, which had evidently not attained sufficient power to make its way through the case. Hence I am induced to believe, either that the females do not appear until some time after the males have quitted their cocoons, or that the empty cells were the construction of a former year. The point at the top of my cocoons, which Mr. Kirby calls a funnel, does not form an aperture, nor is there any corresponding opening in the woolly covering.

Some of the species of the genus Osmia are termed mason bees, since the materials of which they construct their nests are minute grains of sand, cemented together with a glutinous secretion, and which are placed by the insects on the angle of a wall, or the crevices between bricks, &c.: they are of a sufficient size to contain from three to eight, or, according to Geoffroy, fifteen cells, placed irregularly. (*Réaumur*, tom. vi. mém. iii.) Other species of *Osmia* (O. bicornis,

&c.) nidificate in old rotten palings, in which they burrow in an upright direction. The palings in the lane leading from Turnham Green to Chiswick are greatly damaged by the last-mentioned species. I mention this more particularly, because Réaumur states that this species builds its nests in the hollows of large stones. In the first volume of the *Entomol. Magazine* is an account of the habits of O. bicornis, which is therein stated to nidificate in posts, composing its oval cells (about 20 or 30 in number) of clay and sand, glued together. In the *Insect Architecture* (p. 33.) are some observations on the habits of this insect. The males appear a considerable time before the females. Spinola has given a short account of the history of another species of Osmia (O. gallarum, *Ins. Lig.* vol. ii. p. 70.), which selects the abandoned galls of the oak for the place of its nidification, around which it glues the leaves, depositing from twelve to twenty-four eggs in the cells which it constructs within. In the second volume of the *Mémoires de la Société de Physique de Génève* is contained a very interesting memoir, by Huber, upon a solitary bee, which he regards as the Trachusa aurulenta (Apis aurulenta *Panz.*), but which agrees better with Panzer's Apis fusca, and which appears to be another species of this genus. This insect selects the empty shells of snails for the cradle of its progeny.* The history of another wood-boring species, apparently of this genus, is given by Wartmann, in *Der Naturforscher*, stuck xxii.†

The genus Megachile comprises the leaf-cutting, and some other bees. The economy of these insects has long attracted the attention of the curious; and so early as 1670 it was noticed by Ray, Willughby, Lister, &c. Linnæus, supposing that identity of economy

* This insect is therefore identical in its habits (if not specifically) with Osmia helicicola of Rob. Desvoidy, which, together with O. bicolor, was reared by that author from nests formed in the deserted shells of Helix nemoralis and H. nomatia. (See *Comptes Rendus, Acad. des Sciences*, 1836, No. 23., for further details; and *Cyclop. Nat. Hist.* vol. iii. p. 360.)

† M. Audouin has reared one specimen of a small species of Osmia from the first of a series of cells, of which the remainder were filled with spiders, which had evidently been there deposited by some fossorial species, the parent Osmia having taken advantage of the burrow to form its own cell. Such, I apprehend, was also the case with the specimen of Osmia leucomelana, as detected by Mr. Smith, entering the dead sticks of the common bramble, from which *it* might however have excavated the pith, but from which he afterwards reared Odynerus lævipes *Shk.*, which had also made use of the same burrow. (See Shuckard, in *Mag. Nat. Hist.* 1837, p. 491.)

indicated specific identity, has united several distinct species under the name of Apis centuncularis. This genus is well distinguished by the ovate abdomen and the maxillary palpi being very short and two-jointed. In the females, the former part is flattened above, and very woolly beneath; the jaws and labrum, also, are very large; whence the generic name. The species form their nests in the trunks of decayed trees; I have also dug them out of old palings: they are lined with pieces of leaves, of a circular form, which the insects have most dexterously clipped off, by the assistance of their powerful jaws. These pieces are so admirably adjusted together, that, although not covered with any coating of gum, &c., they are honey-tight; the interior surface of each cell is composed of three of these pieces, the bottom being concave, and fitted into the mouth of the cell beneath: six or seven of these cells are found in each burrow. Mr. Kirby has given the history of these bees at great length in his monograph, and has added a translation of Réaumur's account, contained in the fourth memoir of his sixth volume. (See also *Mag. Nat. Hist.* No. 6., for an account of the habits of M. centuncularis; and G. R. Waterhouse, in *Ent. Mag.* vol. iv. p. 497., on the habits of Meg. circumcincta.) The males of M. Willughbiella are distinguished by having the terminal joint of the antennæ thickened, and the fore legs greatly dilated. Réaumur (*Mém.* tom. vi. mém. v. pl. 13.) likewise gave an account of another bee, which he termed "abeille tapissière," and which employs pieces of the leaves of the scarlet poppy of the corn-fields, for the lining of its cells. The precise species, however, remained unknown until Latreille, by again tracing its habits, discovered and described it under the name of Megach. papaveris, in a valuable memoir appended to his *Hist. Nat. des Fourmis*, and which now forms the type of the genus Anthocopa of Serville and St. Fargeau (*Enc. Méth.* tom. x. p. 314.), or rather of Latreille (*Hist. Nat.* tom. xiv.). Other species, as the Megachile muraria (forming the type of St. Fargeau's unpublished genus Chalicodoma, — see Brullé, *Expéd. Scient. de Morée*), are, however, true mason bees. The history of the last-named species has been detailed by Réaumur (tom. vi. mém. iii.), and has been misapplied by Mr. Kirby (*Monogr.* vol. i. p. 178.) to the Osmiæ. Schaeffer has also given an elaborate account of this species in his *Abhandlung* (vol. ii.), illustrated in five plates. Some nests of this species, collected by M. Audouin and myself near Paris, have enabled me to observe the habits of this species, so fully detailed by these authors; and to discover that it is attacked by

several parasites, including Trichodes apiarius, a species of Anthrax, and a large Pimpla. Another species, Megach. senta, places its nests on the stems of vegetables.

The genera Heriades and Chelostoma have the body very long and slender, the males having a singular cavity near the extremity of the abdomen beneath. They nidificate in posts and rails in a manner very similar to the Xylocopæ. An interesting account of the habits of Chelostoma is published in the first volume of the *Entomological Magazine*, from which it appears that the coverings and partitions between the cells are composed of sand. Kennedy (in *Lond. and Edin. Phil. Mag.* Jan. 1837) says that clay is thus used. When at rest, they roll themselves into a ball, taking their repose in the bells of different species of Campanula.

The rare and interesting genus Ceratina (*fig.* 91.13. Cer. cyanea, ♀) appears to form the connecting link between the subfamilies Longilabres and Scopulipedes; its supposed habits and several of its structural characters closely resembling those of Xylocopa. M. Spinola has published a memoir upon the habits of this genus, in the tenth volume of the *Annales du Muséum d'Hist. Nat. de Paris*, 1807. This author states that the nests are formed in the pith of a branch of bramble or briar; but Messrs. Serville and St. Fargeau consider these insects to be parasitic, asserting that they are unprovided with any polliniferous organ, and, consequently, that when found in such situation, it was for the purpose of placing their eggs in the nests of small Osmiæ or Heriades. (*Enc. Méth.* tom. x. p.181.) Mr. Thwaites has, however, confirmed Spinola's statement, having observed it, as he informs me, "nidificating in bramble-sticks, out of which it scoops the pith, and then deposits in them, at regular distances, masses of a coarse sort of honey, on each of which a larva may subsequently be found feeding."

The fourth subfamily, SCOPULIPEDES *Latr.* (or ANTHOPHORIDES), derives its former name from the very thick coating of hairs upon the hind legs of the females, which constitute the pollen-brushes (*fig.* 91.8.). In general, the basal joint of the posterior tarsi has also its extremity angularly produced. These insects have no pollen plates; the abdomen is also destitute of a ventral pollen-brush. The wings have commonly three perfect submarginal cells; the third joint of the antennæ is often long and clavate, being very slender at the base; the mouth is occasionally very considerably developed. These insects, notwith-

standing the shortness of the wings, and the robustness of the body, fly with great strength and rapidity, and with a considerable humming noise. The sexes are often very different, both in structure and colour; the males in some having very long antennæ; in others, the posterior femora are thickened; whilst, in a few the tarsi of the intermediate legs are furnished with curious brushes of hairs. The face is often of a pale yellow colour, and the females are generally of black or more obscure colours. They nidificate in the crevices of old walls or in the ground, preferring banks exposed to the sun. Their cells are composed of earth, and very smooth on the inside. The mouth of the nest is closed with the same material.

The species of Eucera, as the name implies, are distinguished by the great length of the antennæ in the males, which are nearly equal to that of the body. Mr. Kirby has observed that the last ten joints of these organs in this sex are composed of innumerable minute hexagons. The cells of these insects are formed under ground, at the depth of two or three inches: their internal surface is very smooth.

The Anthophoræ, at least the common British species A. retusa, makes its nest not only in hard dry banks, but also in the crevices of walls, burrowing through the mortar, and causing much damage by loosening the bricks. Each nest contains several cells of an oval or elliptical shape, placed irregularly, and covered with a thin white membrane: they are about three quarters of an inch in length. An interesting memoir, by Latreille, is published in the third volume of the *Annales du Muséum*, upon Anthophora parietina: the fourteenth volume of the same work likewise contains another memoir by the same author upon this genus. In *Insect Architecture* (p. 33.) are some details relative to the habits of the typical species A. retusa, which appears very early in the spring. I have observed that this insect, both on the wing and when at rest, does not carry its hind wings on the same plane as the fore wings.

The genus Saropoda seems to connect the preceding insects with the carpenter bees, its structure so nearly approaching Anthophora, that the French authors unite them together; but its habits, according to Mr. Kirby, who observed the proceedings of S. furcata, are quite different, resembling those of Xylocopa. It nidificates in putrescent wood, forming longitudinal burrows, which are divided into nine or ten oval chambers, separated from each other by a sharp kind of cornice, forming the shells of an equal number of cells made of the

scrapings of the wood. The tunnel, except at its top and bottom, which are bent, runs in a straight direction, so that the insect hatched from the lowermost first deposited egg makes its way, in all probability, through the bottom aperture without disturbing its brethren overhead.

We are indebted to Réaumur (*Mém.* tom. vi. mém. iv.) for the history of the carpenter bees, *Xylocopa*, a genus containing the largest species of the family, all of which are exotic, the species described by Mr. Kirby in his *Monograph* having evidently no claim to be regarded as a native species. Their wings are often black, with a fine purple or violet gloss, and some of the species are richly coloured. The females of X. violacea, the species observed by Réaumur in France, appear in the spring, and select posts, palings, espaliers, &c., in gardens, in which they construct (*fig.* 91. 7. mandible of a Chinese species) their burrows, from twelve to fifteen inches in length, and rather more than half an inch in diameter; the top and bottom of the tunnel is curved, having a passage at each end. When completed, they deposit an egg at the bottom, with a proper supply of pollen paste; the whole is then covered with a layer of agglutinated sawdust, formed during the construction of the burrow: the layer thus formed serves not only as the roof of one cell, but as the floor of another which is placed immediately above it. They thus proceed until about a dozen cells are formed. When the larvæ are full grown, they assume the pupa state, head downward, so as to allow the lowermost and oldest to make its way out of the bottom of the burrow as soon as it becomes winged, and which consequently takes place earlier than in those which occupy the upper cells. The late Rev. L. Guilding has published an interesting account of the habits of one of the West Indian species, Xyl. teredo, in the fourteenth volume of the *Linnæan Transactions*, illustrated with numerous figures.

The males of some of the large species (X. latipes, and several others undescribed) have the fore legs greatly dilated.

The fifth and last subfamily of the Apidæ is the Sociales of Latreille (or Apides). Here, dependent upon their social habits, we find each species composed of three kinds of individuals; viz. males, females, and neuters, or workers.* In addition to their gregarious

* When we consider that in the community of the hive bee, consisting, for instance, of at least 2000 males, 50,000 workers, and 1 queen, a single individual of the female

habits, the circumstances of the larvæ being fed from time to time by the worker bees, and the cells being generally of an hexagonal form, they are also distinguished by their peculiar habit of secreting wax for the manufacture of the cells of their nests. In these insects, the outside of the posterior dilated tibiæ is smooth, and hollowed in the neuters into a shining plate, for the reception and carrying of pollen, which has been accumulated by means of the pollen-brushes upon the basal joint of the tarsi of this pair of legs. The maxillary palpi are minute and exarticulate. These bees have the body covered with thick hairs. Some Brazilian species (genus Euglossa) are naked, and of very brilliant colours; their economy is unknown, but their legs are provided with large pollen-plates: some of them, however, as the Aglae cærulea *St. Farg.* (figured in Griffith's *Animal Kingdom*), are destitute of these organs, and are consequently supposed to be parasitic. The same remark also applies to certain British species of humble

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sex should alone be permitted to arrive at perfection, the immense number of 50,000 individuals of that sex being rendered imperfect by a process which prevents them from acquiring their normally perfect state, we cannot but be surprised that the physiological peculiarities connected with the development of the workers, to such a far less perfect extent than that of the true females, have not been yet sufficiently investigated. To assert that it is merely owing to the diminished size of the cell, its horizontal direction, or the quality of the food of the workers, that their sexual organs are rendered abortive, the shape of their tongue, sting, mandibles, and legs, altered, and the abdomen deprived of its wax-pockets, is not sufficient: *the process* by which all this is effected, and the instincts of the creature changed, requires to be investigated. (See Treviranus, in *Zeitschrift für Physiologie*, tom. iii. cap. 2. p. 200., and *Bull. Ferussac*, April 1830; and in Ditto, October 1830; and Espargnet, in *Actes Soc. Bourdeaux*, No. 32., May 1833; and Ditto, in *Bull.* Oct. 1830.) In like manner, the physiological peculiarities whereby, even amongst the imperfect females, or workers, a modification of form is effected, is equally worthy of research; for it must evidently be owing to a principle analogous to that which produces the differences between the female and the ordinary workers, that the latter are still further modified. Thus, in the hive bee, Huber and others have proved that the workers are divided into two classes, namely, the nurse bees and wax workers, differing in size and instincts. Again, some of the workers, differing in shape from the rest, are occasionally fertile, depositing eggs, but which only produce males. (*Bevan*, p. 26. 2d edition.) There are also occasionally observed in the hive other kinds of workers, known to apiarians under the names of captains and black bees. In the humble bee, also, the early-born females, as well as the males, differ in size from their parents, the former, as it appears, only producing male eggs; and Mr. Newport has ascertained that a diversity also exists in the working humble bees. The production of these different kinds of individuals must originate in the peculiarities connected with their treatment by the workers, whilst in the early stages of their existence.

bees, the peculiarities of which did not escape Mr. Kirby; he, however, speaks of the neuters of these species, and suspects that they nidificate under ground. (*Monogr.* vol. i. p. 210.) St. Fargeau, however, taking into consideration their structural incapability to form their own nests, has regarded them as parasitic, and separated them from the true humble bees, under the name of Psithyrus, in the *Annales de la Soc. Ent. de France.*

Referring to the observations which I have already made as to the necessity of regarding general structure, rather than parasitic economy, as of primary importance in the distribution of the bees, I adopt Latreille's division of this subfamily into two sections; those which have the posterior tibiæ spurred, comprising the humble bees, which are temporarily social; and those which have the posterior tibiæ without spurs, consisting of the hive and other honey bees, which are permanently social. St. Fargeau has placed the social bees in his section Hyménoptères phytiphages nidifians sociaux, dividing them into the *Pérennes*, consisting of the families of the ants and Apiarides; the latter divisible into two tribes, 1st, Apiarites (genus Apis); and 2d, Meliponites (genus Melipona): and the *Annuels;* the latter consisting of the social wasps and the humble bees, or family Bombides, composed of the single genus Bombus.

The humble bees, composing the genus Bombus*, are at once known by their large and very hairy bodies: they are the largest species of the Mellifera found in England; and they are often of a black colour, with bands of yellow or orange. They form societies consisting of about fifty or sixty individuals, occasionally, however, amounting to two or

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* Bibliogr. Refer. to the Bombi.

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Labillardière. Note sur les Mœurs des Bourdons, in Mém. du Mus. d'Hist. Nat. tom. i.

Dahlbom. Bombi Scandinaviæ Monogr. 8vo. Lund. 1832.

Lepelletier de Saint Fargeau. Observations on ditto (Annal. Soc. Ent. de France, tom. i.).

Réaumur. Mémoires, tom. vi. mém. i.

Latreille, in Mém. du Mus. tom. iii.

Petit Thouars, in Nouv. Bull. des Sciences, 1814, tom. i.

Goezen, in Der Naturforscher, St. 14.

Drewsen et Schiodte. Bomborum Psithyrorumque Daniæ enumeratio critica, Havniæ, 1838, 8vo.

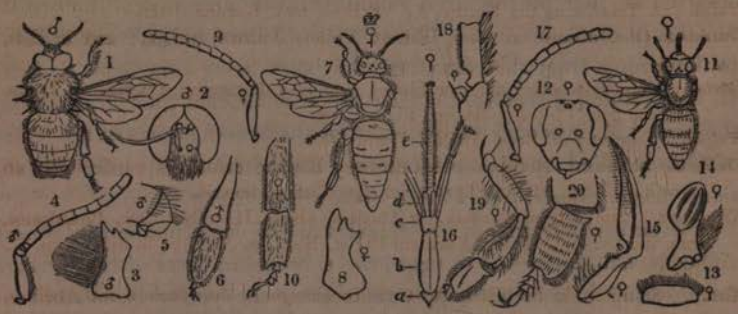
three hundred. They construct their dwellings under-ground in meadows, pastures, or hedge-rows, generally employing moss for this purpose. Their union, however, lasts only till the cold weather kills the great mass of the inhabitants, a few impregnated females alone surviving to become the foundresses of fresh colonies at the commencement of the following spring. The neuters are late in their appearance, being produced from eggs deposited by these foundress bees; and it is not until autumn that the males appear. Unlike the hive bee, the females take their share in the labours of the community, and they are accordingly furnished with two peculiar organs possessed by the neuters, of which the queen of the hive is destitute, although the neuters of the latter insect possess them; namely, the dense fringe of hairs surrounding the pollen-plate of the posterior tibiæ, and the dilated base of the first tarsal joint. The economy of the humble bee also, unlike that of the hive, admits of the presence of numerous females in the same nest. The species of Bombus are very difficult to determine, from the colours of the hairs being very liable to fade. It is essential, therefore, to trace the insects from their first leaving the nest. M. Audouin has proved that the sexual organs of the males of closely allied species present very characteristic specific distinctions. (*Ann. Génér. Sci. Physiq.* tom. viii. p. 285.)

The patient affection of the females in the construction of the nest and cells, and deposition of eggs; the subsequent cares of the workers for insuring a constant supply of food to the young brood, and for securing its escape from its cell when arrived at the perfect state; the construction of the nests and cells; the different kinds of individuals, and their various duties at different periods of the year; the distinction between the females and neuters, and between the two kinds of the former, some of which are of a smaller size than the foundress bees, and produce only male eggs, — (between these small females and the later produced larger ones great jealousy exists: it is the latter which, after impregnation, survive the winter, and deposit their eggs in the following spring, —) these, together with numerous other interesting peculiarities in the history of these insects, are treated upon by the various authors cited above, as well as by St. Fargeau, and Kirby and Spence, in the first and second volumes of their *Introduction*. With respect to the Apathi, Psithyri, or Pseudo-Bombi, as the parasitic Bombi have been named, it is to be observed that, inasmuch as in the hive bee we find those individuals which take no share in the

labours of the hive, namely, the males and queen, unfurnished either with pollen-plates on the hind legs, or auricle at the base of the posterior tarsi; whilst in Bombus this deficiency, as above stated, occurs only in the males, thus indicating the working character of the female humble bees;—so we are strictly warranted by analogy in regarding the Apathi as incapable of working, and consequently as parasitic, since all the individuals of which the different species are composed are alike destitute of these, and some other characters peculiar to working bees. The exotic genus Euglossa is distinguished not only by the great brilliancy of colouring in many of the species, but by the great length of the labium and maxillæ (whence the generic name), and which extend to the extremity of the abdomen.

The hive bee*, and some other analogous species (forming the

Fig. 92.†



second section of the Sociales), have the basal joint of the posterior tarsi striated (*fig.* 92. 20.), and the posterior tibiæ have no spurs at the

* Biblioge. Refer. on the Hive Bee.

Hill. Instruction of Bees. London, 1593. 8vo.

Butler. Feminine Monarchy; or, the History of the Bees. Oxford, 8vo. 1609; and numerous subsequent editions.

Purchas. A Theatre of Political Flying Insects (Bees) 4to. London, 1657.

Miraldi, in Mém. Acad. Roy. des Sciences, 1712.

† The various details in block 92. are those of the hive bee: *fig.* 1. the male or drone; 2. front of its head; 3. mandible; 4. antenna; 5. apex of abdomen laterally; 6. posterior tibia and portion of the tarsus: 7. the queen or female; 8. mandible; 9. antenna; 10. tibia and posterior tarsus: 11. the worker, neuter, or imperfect female; 12. front of head; 13. labrum; 14. mandible; 15. maxilla; 16. labium; 17. antenna; 18. base of anterior tarsus; 19. outside of the hind leg; 20. inside of the posterior tarsus.

extremity, a character not to be found in any other Hymenopterous group. Many volumes have been written upon the natural history of

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Warder. Apiarium; or, a Discourse on Bees. London, 1676. — Ditto, A further Discovery of Bees, 8vo. London, 1680 (by *Rusden*). — Ditto, The True Amazons; or, Monarchy of Bees. London, 8vo. 1713 (edited by *Rusden*).

Dobbs. A Letter concerning Bees, in Philos. Trans. vol. xlv.

Hotton. Letter concerning Swammerdam's Treatise de Apibus, Philos. Trans. 1699.

Thorley. Melissologia; or Female Monarchy. 8vo. London, 1744. — Ditto, An Inquiry into the Nature, &c. of Bees. 8vo. London, 1765. — Description of a curious and useful Hive (Journ. Econom. 1767).

Réaumur. Mémoires, tom. v.

Mills. On the Management of Bees. 8vo. 1766.

Wildman. Treatise on the Management of Bees. 4to. London, 1768.

Hunter, John. Observ. on Bees, in Philos. Trans. 1792.

Keys. A Treatise on the Breeding, &c. of Bees. 12mo. London, 1814.

Huish. A Treatise on the Nature, &c. of Bees. 8vo. London, 1815.

Dunbar. Observations on Bees, Edinb. Philos. Journal, vol. x.; and in Isis, 1832.

Barton. Inquiry whether the true Honey Bee is a Native of America, in Trans. Americ. Soc. Philadelphia, vol. iii.

Knight. Economy of Bees, Philos. Trans. 1807.

Coelho de Scabra. Notice sur les diverses Espèces d'Abeilles particulières en Brazil, in Mém. Math. Phys. Acad. Sc. Lisbon, tom. ii.

Espargnet. Sur la Réproduction des Abeilles (Bull. Hist. Nat. Soc. Bourdeaux, tom. iii. 1829). — Ditto, Essai sur l'Hist. Nat. des Abeilles, in ditto, tom. iv. 1830.

Kœnig. Solution du Problème des Cellules hexagones des Ruches des Abeilles, in Mém. Acad. des Sci., ann. 1739.

Bevan. The Honey Bee. London, 8vo. 1838. 2d edit.

Bagster. On the Management of Bees. London, 1834.

Schirach. Author of numerous Memoirs in German, of which the following are the chief: — On the Female Bee, without Impregnation, to the third Generation, in Abhandl. der Bienenges. Oberlaus. b. i. — Ditto, on Swarming, in ditto, 1766-67, 68. 70. — Ditto, on the Queen Bee, in ditto, 1767. — Ditto, on the Males, in ditto, 1768-69. — Ditto, on the Production of Queens from Worker Larvæ, in ditto, 1768. 1771. — Ditto, Further Observ. on Males, in ditto, 1770 and 1771. — Ditto, New Mode of multiplying Bees, and causing them to swarm in May. 8vo. Badissen, 1761. — Ditto, Melitto-theology. 8vo. Dresden, 1767. — Ditto, on Early-swarming and Queen Bees. 8vo. Badissen, 1770.

Harold. On the Male Bees, in Abhandl. Frank. Bien. Gesellsch, 1772-73.

Bonnet. Lettre sur les Abeilles. Berlin, Samml. 1775.

Rocca. Traité complet sur les Abeilles. 3 tom. 8vo. Paris, 1790.

Needham. Nouv. Recherch. sur les Mouches à Miel, Mém. Acad. Bruxelles, tom. xi.

Huber (F.). Observ. sur les Abeilles. Paris, 1810. 8vo. — Ditto, German

the hive bee, yet many interesting points in their economy still remain undetermined. Of the products of the hive, honey * is by far the most important; and various interesting details as to the production of this substance are contained in the 10th letter of Messrs. Kirby and Spence's first volume; whilst in the 11th and 15th letters will be found much information as to the food and mode of feeding of the larvæ, the construction of the waxen † cells ‡ by the workers, the substances employed in building the nest, and the extraordinary ma-

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edition, Dresden, 1793; English edition, 12mo. London, 1808. — Ditto, 2 vols. Geneva, 1814. (Second volume by P. Huber.)

Latreille. Mémoire sur un Gâteau de Ruche d'Abeille des Grandes Indes, et sur les Différenees des Abeilles proprement dites, vivant en grande Société, de l'Ancien Continent et du Nouveau. Ann. du Mus. d'Hist. Nat. tom. iv. 1804. — Ditto, Notice des Espèces d'Abeilles vivant en grande Société, in ditto, tom. v. 1804. — Ditto, in Mém. du Mus. d'Hist. Nat. tom. viii. 1822 (on the Nature of Wax).

Ramdohr, in Magazin Gesellsch. Naturf. zu Berlin, 1810. 4 band. (Organ of Taste in Bees. 1812 (Organs of Hearing and Smell in Bees); also in Germar's Mag. der Entomol. vol. i.

Hattorf. On Impregnation of Queen Bee, in Abhandl. der Oberlaus. Bienengesel, 1768-69.

Garden. On the Proboscis of Bees. Philos. Trans. No. 175.

Lombard (*C. F.*). Manuel du Propriétaire d'Abeilles. 8vo. Paris, 1802. — Ditto, 6th edition, 1825, 8vo. — Ditto, Etat de nos Connaissances sur les Abeilles au Commencement du 19me Siècle. 8vo. Paris, 1805. — Ditto, Mémoire sur la difficulté de blancher les Cires de France. 8vo. Paris, 1808.

Mackenzie, in Brewster and Jameson's Edinb. Philos. Journal, vol. iii. 1820.

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* Propolis, a resinous substance collected by the bees, consists of one part of wax and four of pure resin; it is collected from various plants, and is used as a strong cement by the bees. (Vauquelin, in *Bull. Soc. Philomat.* No. 57.; De Loche, in *Mém. Acad. Turin,* tom. ii.)

† The true nature of bees' wax has been the subject of much research. (See Latreille, in *Mém. du Muséum,* tom. viii.; De Loche, in *Turin Trans.* vol. ii.; and Treviranus, in *Zeitschr. für Physiologie,* 1828, p. 62.; and *Bull. Sci. Nat.* Jan. 1829.)

‡ Dr. Barclay (in *Wernerian Trans.* vol. ii. p. 260.) has described the partitions between the cells as being all double, each cell being an independent structure; but this peculiarity does not occur in cells of virgin wax, but only in old comb, in which the partitions between the cells do not consist of wax, but of the cocoons spun by the previous occupiers of the nest. Such is the explanation given by Mr. G. R. Waterhouse, and its correctness is easily proved by immersing such cells in boiling water, when they will not dissolve; but Mr. G. Newport, in a memoir read on the 1st of April, 1839, before the same society, adopts a contrary opinion; and moreover asserts that virgin cells are lined with a delicate membrane.

thematical accuracy observed in the formation of the cells*; whilst nearly a quarter of the second volume is occupied with descriptions and accounts of the duties of the various individuals composing the community; descriptions of the preparatory states; the singular power which they possess of causing the development of the queens from neuter grubs, in case of the death of the old queen; the destruction of the female grubs by the latter, their swarming, &c. &c.

The geographical range of the species of the genus Apis (which are distinguished by their possessing three submarginal cells in the wings) is believed to be restricted to the Old World; it is evident however, from the early records of the North American States, that a species of bee, congenerous with the common hive bee, was domesticated there; of which I have received specimens from Philadelphia, which cannot be specifically distinguished from Apis mellifica. A memoir upon this question is contained in the *Transactions of the American Philosophical Society*, Philadelphia, vol. iii. 1793†; see also the remarks of M. Huevel, contained in the German *Isis* for 1823, and republished in the *Bull. Sci. Nat.* March, 1825.

The principal species of bees kept for domestic purposes are the following: — Apis mellifica *Linn.*, or the common hive bee of Europe, and which has also been introduced into the United States of America; Apis ligustica *Spinola*, kept in some parts of Italy; Apis fasciata *Latreille*, in Egypt and some parts of Asia Minor; Apis unicolor *Fabricius*, in Madagascar; Apis Indica *Linn.*, at Bengal; Apis Adansonii *Latr.*, at Senegal; Lacordaire also observed hives of an undescribed species at Chili. A considerable number of other species

* The mathematical precision of the hexagonal cells of the hive has attracted the attention of some of the most profound mathematicians, Kœnig and Réaumur having proved that the different angles of the sides and bottom are precisely those which were fitted for the required construction. Mr. G. R. Waterhouse, in an ingenious article, "Bee," in the *Penny Cyclopædia*, has endeavoured to show that the normal form of the cells is cylindrical; but that, in consequence of the bees working in concert, the space between the cylinders is gradually altered into a straight side, thus forming hexagons instead of cylinders. Lord Brougham (in his *Dissertations on Subjects of Science connected with Natural Theology*, 1839) has entered deeply into the mathematical questions connected with the structure, in opposition to the view of Mr. Waterhouse.

† The fifth volume of the same American work contains an interesting paper "On the Knowledge of the Ancients concerning poisonous Honey," by Dr. Barton: and see Beck's *Elements of Medical Jurisprudence*, edited by Dunlop and Foderè, vol. iv. p. 299. It has also formed the subject of a communication made to the Zoological Society of London, in 1834, by K. E. Abbot, Esq. from Trebizond.

might also be employed in the same manner, with effect. Fabricius cites, amongst others, Apis acrænsis and laboriosa. (See Kirby and Spence, *Introd.* vol. ii. p. 242.)

Spinola (*Insecta Liguriæ*, vol. ii.) has published a long account of the bee employed in Italy for producing honey, and which he has named Apis mellifica ligustica. This species, which is different from our common hive bee, agrees with the description given of the honey bee by Aristotle and other writers of antiquity, inhabitants of Southern Europe; whence it is evident that these authors were unacquainted with the common bee of the North of Europe. Spinola likewise considered his species distinct from Latreille's Egyptian species Apis fasciata, which is annually transported in bee boats down the Nile. (See *Athenæum*, January 1835.)

Other exotic species of this section compose the two genera Melipona (having the basal joint of the posterior tarsi of a triangular form, two submarginal cells, and entire jaws) and Trigona, having toothed jaws, and a more hairy body. The insects of the latter genus, of which Apis amalthea *Fab.* is an example, build their nests at the tops of the branches of trees, out of the reach of monkeys, in the shape of a large pear: the former select cavities in rotten stumps of trees. The nest of a Mexican species of this genus was exhibited at the Linnæan Society, on January 29. 1829, built in the hollow of a log of wood; and which consisted of numerous irregularly-placed oval black-coloured cells, filled with thick amber-coloured honey, amongst which numerous specimens of the bees lay dead. An elaborate essay upon this insect, by Huber, has been published in the *Memoirs of the Society of Geneva*, vol. viii. p. 1. 1837: and an account of this or a similar Mexican nest, by Capt. Beechey, is contained in the third number of the *Journal of the Royal Institution*. (See also *Bevan*, chap. 23.)

The memoir of Scabra (*Noticia de diversas Especies de Abelhas que dao mel proprias do Brasil, o desconhecidas na Europa*, folio, Lisbon, 1799) should also be noticed. (See *Bull. Sc. Nat.* January 1830.*) Latreille has described many species of these exotic honey bees in the appendix to the travels of Humboldt and Bonpland; but it may be easily conceived how much remains unknown of the habits of the exotic species, when it is stated, that out of thirty-five species of

* In the Journal of the Geographical Society (quoted in *Ent. Mag.* vol. v. p. 119.) is a memoir upon the management of bees in Cachmere.

Melipona described by St. Fargeau, in his *Hist. Nat. Hymenopt.*, a single male only was observed; and it is probable that not a single female exists in collections — neuters only being known. This author has added another genus, Tetragona, established upon the neuters of other Brazilian species; and Messrs. Kirby and Spence observe (*Introd.* vol. iv. p. 497.) that the honey bee is replaced in New Holland by another distinct but undescribed type.*

Order STREPSIPTERA† *Kirby.*

(Rhipiptera *Latr.*; Diptera Rhipidoptera *Lamarck.*)

Char. Anterior wings transformed into a pair of short slender contorted appendages; posterior wings very large, folding longitudinally like a fan.

Mouth with two slender acute jaws, wide apart, and two large biarticulate palpi.

Tarsi 2-, 3-, or 4-jointed.

Larva apod and vermiform, with a flattened head.

Pupa coarctate and inactive.

Fig. 93.

We are now arrived at a small group of insects, which may be re-

* The Horticultural Society of London, in 1825, received a hive of bees from New Holland, differing materially from the bees of Europe, "being infinitely smaller and wholly without stings." (*Literary Gazette*, 1825, p. 443.)

† Bibliogr. Refer. to the Strepsiptera.

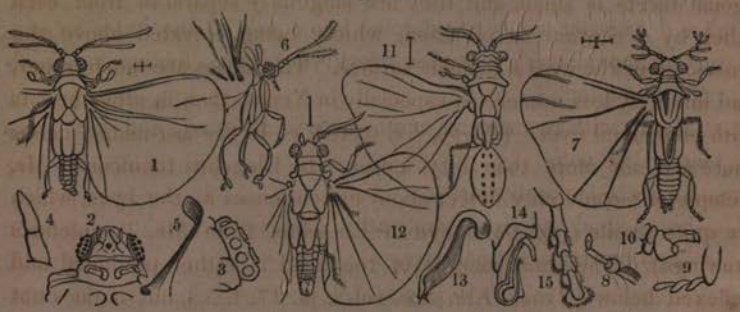
Rossi. Fauna Etrusca Mantissa (tab. 8. fig. B. 6., Suppl. tom. ii. p. 114. pl. 7. f. B.).

Kirby, in Monogr. Apum Angl. vol. ii. p. 111. — Ditto, in Sowerby's British

garded as the most anomalous annulose animals with which we are acquainted; and which, either as respects their anatomical characters, or the many obscure points connected with their economy, may justly be considered to merit the epithet bestowed upon one of them by Latreille: "Systemata entomologica perturbare videtur cum ex ordinibus omnibus repellatur—animalculum—animum excrucians. Tempus ducamus, et dies alteri lucem afferrent." (*Gen. Crust. &c.* tom. iv. p. 388.)

The insects of which this order is composed are of small size, the largest not reaching a quarter of an inch in length. (Frontispiece,

Fig. 94.



Vol. I. *fig.* 6., represents Stylops Spencii, and *fig.* 93. 1. the same laterally; *fig.* 94. 1. Elenchus tenuicornis; 94. 7. Halictophagus Curtisii;

Miscell. pl. 45. — Ditto, in Trans. Linn. Soc. vol. xi. (bis). — Abstract in Bull. Soc. Philomat. 1815; and Germar, Mag. d'Ent. tom. ii.

Jurine. Observ. sur les Xenos Vesparum, in Mém. Acad. Turin, tom. xxiii.

Leach, in Zool. Miscellany, vol. iii. p. 133. (Stylops Kirbii). — Ditto, in Journ. du Physique, No. 88. 1819.

Curtis. British Entomology, pl. 226. (Stylops), 385. (Elenchus); and 433. (Halictophagus).

Pickering, in Trans. Ent. Soc. vol. i. p. 170. (Stylops Spencii).

Westwood, in Mag. Nat. Hist. No. 26. May 1832. — Ditto, in Trans. Ent. Soc. vol. i. (Observ. upon the Strepsiptera, and Descr. of Elenchus Templetonii). —Ditto, vol. ii. (Description of Parasites found upon the Larva of Stylops).— Ditto, in Griffith's Animal Kingdom Ins.[1] pl. 59. (Stylops Childrenii *Gray.*)

Guérin and Percheron. Gen. des Insectes Rhipipt. pl. 1. (X. Vesparum).

[1] No account is given in the text of this work as to the locality of the species here figured and dissected. I am enabled, however, to state, that it was obtained by Mr. G. B. Sowerby from the abdomen of a bee, forming part of a collection received by him from Nova Scotia.

94. 11. Xenos Rossii, after Jurine; 94. 12. the same from nature.) The body is long and narrow, its greatest extent being occupied by a very large and singularly developed thorax. The general character of the body indicates great weakness, and we accordingly find that the insects live but a very short time in the imago state. The head and thorax are of a velvety texture. The head is distinct and exposed (*fig.* 93. 2. head of S. Spencii; 93. 3. ditto of S. Childrenii; 94. 2. under side of head, and front of body of Elenchus): it is transverse, with the eyes very large, lateral, and prominent, being placed upon the contracted sides of the head, which gives them the appearance of being inserted upon short foot-stalks. The number of hexagonal facets is small, and they are singularly separated from each other by a septum or partition, which, being elevated above the lenses, gives the eyes a cellular surface. The lenses are much larger, and infinitely less numerous, especially in Xenos, than in other insects with compound eyes. (*Kirby, l. c.* p. 104.) In the last-named genus there are not more than fifty lenses. In Elenchus tenuicornis Mr. Templeton* could only detect about fifteen lenses in the eyes, which are quite sessile (*fig.* 94. 3. eye of Elenchus, from Mr. Templeton's drawings). The front margin of the head is rather produced and deflexed below (*Trans. Ent. Soc.* vol. i. pl. 17. f. 5.), but it does not appear to exhibit any transverse impression indicating the existence of a distinct clypeus, or upper lip; such, at least, is its character in the recent specimens which I have examined. Savigny, however, described this deflexed gradually narrowed part of the head, as a moveable labrum, in the "characteres oris" which he communicated to Dr. Leach (*Zool. Misc.* vol. iii. p. 133).† The composition of the mouth is very singular, exhibiting none of that complicated structure which we have seen in many of the preceding insects. This is, in effect, to be attributed to the fact, that the imago takes little, if any, food during its short existence.‡ In the various specimens which I have examined and dissected, I have not, indeed, been able to detect

* I am indebted to this gentleman not only for his unique specimen of Elenchus tenuicornis, together with specimens of his minute Mauritian Elenchus, but also for an elaborate MS. description and figures of the former species.

† Jurine describes Xenos vesparum as having "deux lèvres, une supérieure, large, et ciliée, et une inférieure beaucoup plus petite."

‡ Speaking of the Xenos Peckii, Professor Peck states that it probably does not feed in the perfect state, like some Phalænæ, and only continues the species. (*Linn. Trans.* vol. xi. p. 92.)

any distinct oral aperture. There is, it is true, a transverse impression on the back of the under side of the head, with a smaller one more in front (described by Curtis as the pharynx, *Brit. Ent.* pl. 226. fig. *E. a.*). At each side of the former (which extends nearly across the head) arises a long, narrow, nearly straight, somewhat lancet-like appendage, arising from a slightly dilated (articulated?) base (*fig.* 93. 4.): these pieces are directed forwards, but in a converging direction, so that their points cross*; immediately behind these instruments arises a pair of very large two-jointed organs, also directed forwards, the basal joint being obliquely truncate, and the terminal point inserted somewhat laterally (*fig.* 93. 4. 94. 4. palpus of Elenchus). Savigny, who undertook the examination of the mouth of one of these insects, forwarded to him by Dr. Leach, regarded the pair of long, lancet-like organs as mandibles, and the basal joint of the last-described organs as the maxillæ, whilst the terminal joint he regarded alone as representing the maxillary palpus; the labium he regarded as the piece soldered to the under side of the head, destitute of a ligula or labial palpi. (*Zool. Misc.* vol. iii. p. 133.) Kirby also regarded the lancet-like organs as mandibles, and the articulated ones as maxillary palpi. (*Linn. Trans.* vol. ii. p. 103.) Upon these considerations, the order has been regarded as mandibulated. Mr. Newman, on the other hand, considers it as not sufficiently separated from the Diptera, "its mandibles being elongate, linear, and without any horizontal motion; its maxipalpi fully developed, as in Diptera, but the maxillæ scarcely discernible; its labium distinct and triangular, as in Lepidoptera, but the labipalpi minute or obsolete." (*Ent. Mag.* vol. ii. p. 327.) I cannot, however, find the least analogy between the oral organisation of the Strepsiptera and the tubularly developed elbowed mouth of the Diptera, the labium of which is greatly elongated; whereas, on the contrary, there seems to me much greater resemblance, in this respect, between the Strepsiptera and Lepidoptera, the labium in both being soldered flatly to the head, the acute mandibles, as they have been termed in Stylops, being exactly represented in some of Linnæan Bombyces, by the short rudimental maxillæ, and the large articulated

* Professor Peck asks what can be the use of these instruments: they are not strong enough to enable the insect to cut its way through the paper cells of the wasp's comb: can they be useful in opening the sides of the larva for depositing the eggs? Neither of these suggestions are, however, applicable to Stylops.

appendages being much more analogous to the labial palpi of the Lepidoptera, than to the maxillary palpi of the Diptera. (Comp. *Curtis*, 24. f. 6. Gastropacha; or 328. f. 3, 4. Ptilophora.)

The antennæ are of singular construction, although consisting of but a few joints: they arise between the front of the eyes near the base of the contracted ocular foot-stalks. The basal joint is thick, and enlarged to the tip; the second joint small, or of moderate size. In Stylops the antennæ are furcate, the third joint being produced, on the outside below, into an elongated flattened plate nearly as long as the remainder of the antennæ: the fourth joint is inserted near the base of this plate, on its upper side *; it is rather depressed, and about half as long as the third joint: the fifth and sixth joints are still shorter and more slender (*fig.* 93. 5.). In Elenchus (*fig.* 94. 1. and 6. side of the front of the body, showing the antennæ and pseudelytron, after Curtis) the antennæ are also furcate after the second joint, but the third joint is much more slender and elongated than in Stylops; and there only appear to be two other joints, which are also more elongated and slenderer. In Xenos (*fig.* 94. 12.) the furcations of the antennæ (after the second joint) are nearly of equal size, the third joint emitting from its base a single-jointed branch; so that, in this genus, these organs are apparently only 4-jointed. In Halictophagus (*fig.* 94. 7.) the antennæ are more regularly constructed; consisting of seven joints, those after the second joint being flabellated, each (except the last, which is elongated) emitting a thickened branch. Mr. Kirby noticed the analogy which existed between the antennæ of some of these insects and many Coleoptera and Hymenoptera, which have branching or furcate antennæ. But it is to be observed, that, with the exception of a very few (Gyrinus, Parnus), antennæ thus constructed are found only amongst male insects; and hence it appears to me not improbable that all the winged individuals of this order, yet discovered, are males†, all exhibiting a complicated structure in their antennæ: this is especially the case with Halictophagus.

The thorax is very large, oblong, and singularly developed, con-

* Mr. Kirby describes the third and fourth joints as both arising from the preceding.

† Professor Peck considered that all his specimens of X. Peckii, which were alike, were males (*Linn. Trans.* vol. xi. p. 91.); but Mr. Kirby, chiefly regarding the anal appendages as an oviduct, apprehended that they were females. Rossi states that he was acquainted with both sexes of Xenos, but Jurine doubts this. All the specimens reared by the latter (as many as twenty) were exactly alike.

sisting of a very small, collar-like prothorax and mesothorax, and an immense metathorax; this structure corresponding, as we shall see, with the slight development of the anterior, and the disproportionately large size of the posterior wings (*fig.* 93. 6. represents a lateral view of the body of Stylops Childrenii with the head and wings removed). On carefully removing the prothorax, it is found to consist of a simple ring or collar (*fig.* 93. 7. dotted), to which the fore legs are attached on the under side. The mesothorax (*fig.* 93. 8.) is nearly similar, and scarcely of larger size, having the mesothoracic legs on its under side. It is moreover furnished with a pair of small singular appendages, which have been the subject of great controversy. These organs have been termed prébalanciers*, præhalteres, pseudhalteres, pseudelytra, or anterior wings (*fig.* 94. 5. pseudelytron of Elenchus, 94. 13. ditto of Xenos). They are narrow, elongated, curved, and channelled processes, thickened at the tips, originating close to the anterior and lateral edge of the mesothorax, and so nearly to the fore legs, that F. Bauer, who executed the drawings of the dissections for Mr. Kirby's memoir (*Linn. Trans.* vol. xi. tab. 9.), figured them as connected together by a very minute membrane. If such were actually the case, these organs would of course be prothoracic, and not representatives of the mesothoracic or fore wings; and hence Latreille rejected the name Strepsiptera (proposed for the order by Mr. Kirby, on the supposition that they were representations of the fore wings, although contrary to Bauer's views). More recent observations have, however, demonstrated that these organs are attached to the mesothorax†, and are consequently analogous

* In the seventeenth number of the *Zoological Journal*, the pseudelytra and prébalanciers are erroneously spoken of as distinct organs.

† Latreille, *Annal. Génér. des Scienc. Physiq.* p. 6. fig. 18. 8.; Curtis, pl. 226. fig. K.; Griffith, *Anim. King. Ins.* pl. 59.; Westw. *M. N. H.* May, 1832. MacLeay (*Horæ Ent.* 423.*), although considering these appendages as prothoracic, insists on the propriety of Kirby's name, because it is admitted that they are twisted, and that they are used in flight. The names of the orders of insects being, however, founded upon the mesothoracic and metathoracic alary appendages, such a nomenclature would be untenable. As it is, these organs are mesothoracic, and therefore real wings; and thus Kirby's name is correct. Mr. MacLeay has subsequently adopted the opinion that the pseudhalteres are true elytra, and that "consequently the only wings the insect possesses are the under wings, the paraptera of which are enormously developed, as well as the epimera of the metathorax;" adding, however, the remark, "The insect, in fact, ceases to be so very extraordinaay." (*Zool. Journ.* No. 18. p. 176.)

to such elytra as we find in Atractocerus (Vol. I. p. 276 *fig.* 31. 1.), Symbius (*ibid.* p. 291. *fig.* 33. 16.), &c. Latreille, however, regarded them rather as analogous to the mesothoracic tegulæ, or basal wing-covers of the Lepidoptera; or as representing the lateral prolongations of the prothorax * observed in some species of Psychoda or Scenopinus. (Latreille, in *Mém. du Mus.* tom. vii. and *Cours d'Entomol.* p. 242.) The position of the second pair of legs, attached to the same segment as these organs (see *Curtis*, pl. 226. fig. K; and my figure of S. Childrenii, *Griff. An. K.* pl. 59, fig. 1. *i, j, k, l, m, n*), clearly proves them to be mesothoracic. It is true that the great size of the only pair of the actual organs of flight of the Strepsiptera, might suggest an analogy with the large size of the wings of the Diptera, which are mesothoracic, but it appears evident to me that a more correct analogy exists with Phasma, Atractocerus, &c.

The metathorax is of very large size, and of an oblong form, rounded behind, and projecting over the basal dorsal segments of the abdomen. The front part of its dorsum is divided by diagonal lines into four portions, the anterior of which bears some resemblance to the Coleopterous scutellum (and is so named by Kirby, *Linn. Trans.* vol. xi. pl. 9. fig. 4. *e*), but it is, as I apprehend, a component part of the metathorax itself; the posterior part of the dorsum is dilated considerably at the sides (the dilated parts being termed femoralia by Kirby, *l. c.* fig. 4. *l l*), with a deep anterior impression, and forms a very large postscutellum. It is difficult to assign to these regions their strict analogous names. The anterior scutellum-like piece is, however, considered by Perchéron (*Gen. des Ins. Rhipipt.* pl. 1.) as the præscutum; the two lateral triangular pieces following (or the lumbi *Kirby*, *l. c.* fig. 4. *f f*) as conjointly forming the scutum; the middle triangular piece, with the apex pointing forwards (or the interlumbium *K.*, *l. c.* fig. 4. *h*), as the scutellum; and the large posterior piece (or the proscutellum *K.*, *l. c.* fig. 4. *k*) as the postscutellum. The transverse piece at the base of the latter is overlooked by Perchéron in his description, although clearly represented in his figure. It is named the postlumbium by Kirby (*l. c.* fig. 4. *i*). The under-surface of the metasternum presents towards the base a strong inclination where the middle legs are lodged, which is succeeded by a flattened piece, dilated at the

* Some of the large exotic Lamiides have a moveable spiniferous tubercle on each side of the prothorax. (Umbones *K.* and *S.*)

place of insertion of the hind legs, which is at the extremity of the metasternum.* The true wings are attached at the anterior lateral angles of the metathorax: they are of very large size, somewhat exceeding a quadrant of a circle; they are rather opake and membranous, with the anterior margin incrassated; and with a very few longitudinal veins, some of which are abbreviated, by means of which the wings are folded up longitudinally at the sides of the body. The legs are of moderate length, and considerable weakness, but the coxæ of the two anterior pairs are elongated, giving them considerable powers of motion. The femora are simple; the tibiæ not furnished with spurs; and the tarsal joints are furnished beneath with large fleshy cushions, without any terminal ungues. In Stylops the last joint is deeply notched (*fig.* 93. 9.), but it is entire in Xenos (*fig.* 94. 15.). In Elenchus the tarsi are apparently only two-jointed, and in Halictophagus 3-jointed (*fig.* 94. 8, 9.), whilst in Stylops and Xenos they are 4-jointed.† The abdomen is fleshy, soft, and composed apparently of eight segments, the last of which is furnished with a complicated anal apparatus, consisting of a deflexed corneous flattened narrow lobe, and a recurved horny and dilated point (*fig.* 94. 14. extremity of abdomen of Xenos; 94. 10. ditto of Halictophagus). After death this part of the body shrinks up; but during life it is swollen, of a dirty pale colour, with transverse dark-coloured scaly plates.‡

These insects are parasitic, in their early states, in the bodies of

* Mr. Newman adopts a different view of the parts of the thorax, regarding it as constructed on the plan of that of the Diptera, considering the prothorax as very slender, the mesothorax as very large, with its scutellum remarkably elongate (or the proscutellum *K.*), and the metathorax as visible on each side of the latter (being the femoralia *K.*). The pseudelytra he considers as analogous to the tippets of the Lepidoptera, the large wings as the fore wings, and he mentions "a pair of crumpled opaque whitish hind wings, which are somewhat pedunculated, and much resemble the hind wings or halteres of Diptera. My friend, Mr. Walker, called my attention to these," which he describes as attached to the part considered by him as the metathorax. I do not hesitate in considering that there must be some error in the latter observations, as no other author has ever seen any thing answering to the last described appendages, which were probably tattered parts of the true wings. Jurine regards the proscutellum and femoralia of Kirby as alone constituting the metathorax.

† Jurine describes the tarsi of X. *Rossii* (Vesparum *R.*) as 5-jointed.

‡ Mr. Curtis, in his Observations upon Elenchus, speaks of a male? captured by Mr. Dale, and females by Messrs. Haliday and Walker. His figures *D.* and *W.* probably represent these individuals, but I apprehend that they are all of the same sex, namely, males.

various bees and wasps*, the larva, when full-grown, protruding its head between the abdominal segments of these insects, appearing, at first sight, like a small flattened acarus. The full-grown larvæ of Stylops are nearly cylindrical fleshy grubs, about a quarter of an inch long (*fig.* 93. 10. laterally, 93. 11. dorsally viewed), of a white colour, with the head distinct and flattened, and attached to the body by a narrow neck: the head is not at this time provided with distinct mandibles, &c., but appears only to be provided with several small elevated tubercles (*fig.* 93. 12. front of upper side of the head, 93. 13. ditto under side), behind which is a transverse impression; and the posterior angles of the head are rounded and elevated. In several larva which I have examined in a living state, the anterior part of the dorsum exhibited a more distinctly coriaceous texture, and seven articulations; but the terminal part was quite exarticulate. Mr. Kirby describes the supposed pupa of S. Melittæ in a similar manner. (*Linn. Trans.* vol. ii. p. 233.) The precise manner in which this larva feeds is not known: Professor Peck, however, distinctly states, that in the feeding state the head of the larva is near the base of the abdomen of the wasp, as he found by dissection; and that, when the feeding state is passed, it is easy to conceive that it turns, and with its flattened head separates the membrane which connects the abdominal scuta, and protrudes itself a little way, accurately closing the aperture, which is but

* The presence of these parasites is at once indicated by the swollen and distorted appearance of the abdomen of the bee or wasp. There are generally two or three parasites in each infested insect, but in a Polistes gallica, presented to me by Mr. Broome, there are no less than five of the heads of the larva of Xenos exserted (*fig.* 93. 20.); and Jurine mentions having observed as many as six entirely within the body of a Polistes. Upon comparing the volume of the internal air vessels and abdominal viscera of a stylopized bee with those of one not thus attacked, I immediately observed that the former were very considerably reduced in size; and although the ovaries were easily perceived in the unattacked individual, I was unable to perceive them in the former: hence I should consider that Mr. Kirby's supposition that the presence of these parasites renders the insects attacked abortive, is well founded. They do not destroy the bee or wasp, as it is not an uncommon circumstance to meet with these insects with the exuviæ of the Strepsiptera still remaining in them. M. Dufour states that they "n'attaquent point les viscères de l'insecte, et ne vivent qu'aux dépens de son tissu adipeux splanchnique. (*Ann. Sci. Nat.* Jan. 1837. p. 19.) Mr. Kirby states, that he does not recollect observing the exuviæ in a male bee. (*Introd. to Ent.* vol. iv. p. 209.) They are certainly found for the most part in female bees, but I have known them occur in individuals of the opposite sex. (And see *Ent. Mag.* vol. ii. p. 327.) Jurine also observes, that male Polistes are attacked as well as females.

just large enough to admit it. All this time the wasp is active, and associates with its companions. When just protruded, the head of the larva is of a pale brownish colour, but by degrees it assumes a rounder form, and becomes almost black.

On endeavouring to remove one of these full-grown larvæ, the head of which was exserted, I found it impossible to detach it, although I had widened the space where the head protruded, the neck being apparently in some manner attached to the interior surface of the bee's abdomen. After much difficulty, I ascertained that this attachment was caused by a fine thread extending from one side of the neck, and firmly attached to the abdomen (*fig.* 93.15.) of the bee.* Whether this thread was tubular or not, I cannot state; but the circumstance, combined with the want of manducatory organs in the head of the Stylops larva, as noticed by Jurine, seems to favour the opinion originally entertained by Mr. Kirby, that the Stylops, in its larva state, feeds by absorption. I would, however, by no means wish it to be considered that this view of the subject is satisfactorily established, even although it appears to be confirmed by the examination of the exuvia of a Stylops larva remaining within the abdomen of a bee after the perfect Stylops had escaped. This, on removal, was found to consist of a thin and transparent pellicle (*fig.* 93. 14.), being of a long, cylindrical, and narrowed form, having the dorsal portion more darkly shaded, and presenting the appearance of indistinct articulations. This, therefore, was undoubtedly the larva-skin of the insect: the neck exhibited the thickened appearance visible in the neck of the larva, and precisely in the same situation that the thread above noticed was attached in the larva, I observed an apparent spiracle or circular aperture connected with an incrassated and apparently tubular process of the neck. Within the pellicle I likewise observed a long thread, which appeared to arise from the same aperture; but this might possibly be accidental, as it was removed without any difficulty or rupture.

* Mr. Newman (*Mag. Nat. Hist.* No. 23.), after making the observation quoted above (p. 147. note ‡), questions whether Stylops may not feed in a similar manner. L. Dufour (*Ann. Sci. Nat.* Jan. 1837, p. 16.) describes a larva, probably of a Stylops, found in Andrena aterrima, and attached upon one of the large trachean vesicles, which occupy the base of the abdominal cavity of this bee, by means of two trachean trunks, which entered the body of the larva near the anterior extremity, whereby it obtained a supply of air in a manner quite anomalous.

Within this last-named pellicle I also observed near its posterior extremity another crumpled-up mass of pellicle of a dark opake colour, perfectly distinct from the pellicle of the larva itself, and which had evidently formed the covering of the enclosed pupa, and had been shed by it previous to the time when the imago had escaped. Hence, as well as from the account given by Jurine, it is evident that the pupa of the Stylops is enclosed in a distinct skin, and is also in that state enveloped by the skin of the larva *, contrary to the suggestion of Mr. Kirby (*Linn. Trans.* vol. xi. p. 97.); and hence the accounts and figures given by most authors of the pupa of these insects are in fact merely representations of the larva in an altered form, but totally different from that of the real pupa, which no author, except Jurine, has seen.† Figure 93. 16. is copied from Curtis's *Brit. Ent.* pl. 226, and is described by that author as a pupa in which the head is wider, the eyes appearing through, and in a different situation, and the inferior wings are folded laterally; in a specimen of the imago, extracted from the pupa, they met over the body. (Curtis's *Addend. to Stylops.*)

Jurine's figure of the larva of Xenos Vesparum *Rossi* (*Turin Trans.* vol. xxiii. f. 3.) differs from that given above of Stylops; the head being represented as small, and succeeded by a very large nearly quadrate segment, with two frontal and several longitudinal tubercles, followed by eight transverse joints, gradually narrowed to the end of the body. Professor Peck's figures of the larva of X. Peckii represent the body as consisting of a regular series of transverse segments. These figures disagree, however, with specimens of the larvæ of X. vesparum, kindly sent to me, in spirits, by the Senator Van Heyden, of Frankfort on the Maine, together with specimens of the pupa in different stages of development, the larvæ precisely agreeing with those of

* "Hæ pupæ, si acûs ope e loco penitus extrahantur abruptoque tegumento leniter deinde tunicâ seu veste albâ propriâ exuantur." (*Rossi.*) Professor Peck, indeed, figures the head of the pupa as furnished on each side, behind, with a number of pellucid hexagons (*Linn. Trans.* vol. xi. pl. 8. fig. 7.), whence Mr. Kirby was led to suppose that the skin of the head, at least of the larva, had been rejected (but I have never seen any thing analogous to this in the exserted heads of the pupæ of Stylops); and hence Mr. Kirby considers the metamorphoses of these insects as intermediate between incomplete and coarctate.

† Dufour describes the larva of Xenos Rossii in its first state, but his description of the pupa is merely that of the larva in its altered form. (*Ann. Sci. Nat.* Jan. 1837, pl. 1. *A.* fig. 15.)

Stylops. Perchéron copies Jurine's figures of the larva and pupa, but adds, "Je doute beaucoup de leur exactitude;" that of the pupa is, however, correct, agreeing with that which I have given (*fig.* 93. 17.) of the most advanced pupa of Xenos sent me by Van Heyden, and in which the resemblance to the imago is at once perceived, the limbs being seen to be distinctly formed, but enclosed in fine sheaths, and laid upon the breast; the wings not extending beyond the extremity of the thorax. The abdomen at this time is considerably swollen.

Mr. Kirby's account of the discovery of these insects, and of the bursting forth of the imago, is so interesting, that the following extract will not be deemed out of place: after mentioning that he had repeatedly observed something upon the abdomen of various Andrenæ, which he had at first regarded as a kind of acarus, he at length determined to examine and describe one of them: "But what was my astonishment when, upon attempting to disengage it with a pin, I drew forth from the body of the bee a white fleshy larva a quarter of an inch long, the head of which I had mistaken for an acarus. How this animal receives its nourishment seems a mystery. Upon examining the head, under a strong magnifier, I could not discover any mouth or proboscis with which it might perforate the corneous covering of the abdomen, and so support itself by suction: on the under side of the head, at its junction with the body, there was a concavity; but I could observe nothing in this but a uniform unbroken surface. As the body of the animal is inserted in the body of the bee, does that part receive its nutriment from it by absorption? After I had examined one specimen, I attempted to extract a second; and the reader may imagine how greatly my astonishment was increased when, after I had drawn it out but a little way, I saw its skin burst, and a head as black as ink, with large staring eyes and antennæ, consisting of two branches, break forth, and move itself briskly from side to side. It looked like a little imp of darkness just emerging from the infernal regions. I was impatient to become better acquainted with so singular a creature. When it was completely disengaged*, and I

* Latreille imagines that pseudhalteres are serviceable in enabling the Stylops to disengage itself from between the scales of the abdomen of the insects within which it has lived. (*Règne Ann.* tom. v. p. 427.) Mr. Thwaites has observed that the imago discharges a thickened dusky-coloured fluid, with which the abdomen had been distended shortly after it is disengaged from the body of the bee.

had secured it from making its escape, I set myself to examine it as accurately as possible; and I found, after a careful inquiry, that I had not only got a nondescript, but also an insect of a new genus, whose very class [order] seemed dubious. (*Mon. Ap. Angliæ*, vol. ii. p. 111.)

In the perfect state, these insects are but short-lived delicate creatures. Mr. Dale, who has been very fortunate in his discoveries of this order, thus describes the proceedings of one which he caught flying, on the 7th of May *, over a quickset hedge of a garden. "It looked milk-white on the wing, with a jet-black body, and totally unlike any thing else; it flew with an undulating or vacillating motion amongst the young shoots, and I could not catch it till it settled on one, when it ran up and down, its wings in motion, and making a considerable buzz or hum, as loud as a Sesia; it twisted about its rather long tail, and turned it up like a Staphylinus. I put it under a glass, and placed it in the sun; it became quite furious in its confinement, and never ceased running about for two hours. The elytra, or processes, were kept in quick vibration as well as the wings; it buzzed against the sides of the glass with its head touching it, and tumbled about on its back. By putting two bees (A. labialis) under a glass in the sun, two Stylops were produced: the bees seemed uneasy, and went up towards them, but evidently with caution, as if to fight; and moving their antennæ towards them, retreated. I once thought the bee attempted to seize it; but the oddest thing was to see the Stylops get on the body of the bee and ride about, the latter using every effort to throw his rider." (*Brit. Ent.* fol. 226.) The bees were quite mad immediately before the Stylops came out; and when on the body of the bee, the Stylops kept its wings still and half erect. Professor Peck also states that a Xenos, which he placed under a watch glass, coursed round its prison with surprising trepidation as long as it lived, which was but a few hours. Mr. Dale also states, that all the Strepsiptera appear to be short-lived (*Curtis*, 433.), and Mr. Haliday confirms this (*Ibid.* 385.) Mr. Stephens also captured a specimen of Elenchus tenuicornis whilst sweeping low herbage, and observed that it was very active, moving its pseudelytra with great rapidity. (*Trans. Ent. Soc.* vol. i. App. p. 65.)

Mr. Pickering found a living Andrena in the imago state in a sand bank in the month of December (which had evidently never quitted

* I have captured specimens of Stylops Melittæ at large, in the months of April and May.

its cell subsequently to arriving at the perfect state, but was waiting for the arrival of spring weather), the abdomen of which exhibited at that time the heads of three Stylops larvæ; on scaling off one of which, a living specimen of the imago of Stylops Spencii (Frontisp. Vol. I. *fig.* 6.) was disclosed; the two other specimens were still in the larva state: hence, as the cell of the Andrena is closed by the parent at the period of the deposition of the egg with a mass of pollen paste, it would appear that the parent Stylops must make its way into the cell before it is closed.* The cells of Polistes gallica (*antè*, p. 239. *fig.* 19.) (a species infested by Xenos vesparum) are not closed until the larva of that wasp is ready to assume the pupa state; and hence Professor Peck considered that the Xenos deposited its eggs in the larva of the Polistes (*Linn. Trans.* vol. ii. p. 92.). Mr. Kirby, however (*loc. cit.*), reasoning from analogy, doubts whether the egg is laid in the wasp in its *first* state, and the larva feeds upon it in its *last*. Rossi, however, was of this opinion, since he says of X. vesparum, "Cui vespæ larva antequam cellulæ clauderentur forte incunabula dedisse videtur." These circumstances are of considerable interest as regards the natural history of these insects, since we are unacquainted not only with the distinctions of the sexes, but also with the situation in which the eggs or larvæ are deposited, and at what period, or in what manner, the connexion between these Hymenoptera and their parasites commences. Reasoning from analogy, we might suppose that in the case of the Andrena, the Stylops has the same instinct as the Chrysididæ, or other cuckoo-like Hymenopterous parasites, which lay their eggs in the nests of Hymenoptera formed in sand or wood, and which are similarly closed as soon as the egg and supply of food are deposited, and of course before the larva of the fosterer is hatched. The larvæ of these Hymenopterous parasites are, it is true, external feeders, but it is not difficult to suppose that the Stylops larvæ, if hatched after the bee larvæ, may, as soon as hatched, eat into the body of the latter, or even into the pupa. The eggs of Xenos may, on the other hand, be at once introduced into the body of

* G. H. K. Thwaites, Esq., reared many specimens of a Stylops (one of which he kindly presented to me), chiefly from females of a species of Andrena, at the beginning of May 1838. The male bees, he observed (in a letter to me), do not appear till the third week in May; and at the beginning of June he again observed the females of the same bee, but not one of these was infested, so that the stylopized bees are at least a month earlier than the others; hence he questions whether the short-lived Stylops can lay its eggs in the cells of the latter bees.

the Polistes larva, in consequence of its cell not being closed, but the same mode of proceeding more probably takes place in both genera. We may in like manner, from analogy with what is known relative to the development of the Ichneumonideous parasites, easily imagine that the parasite larva may remain as such in the various states of the bee's or wasp's development, and not undergo its change to the pupa state until the latter has arrived at the imago state. But these are mere conjectures, which, from the anomalous character of the Strepsiptera, may possibly be quite contrary to the real economy of these parasites; but the facts now known relative to their habits will not warrant us in adopting the supposition of Messrs. Kirby and Spence, that the eggs are apparently deposited in the abdomens of the perfect bees or wasps on which the larvæ feed; indeed, although the simultaneous appearance of the bees and the winged Stylops may at first seem to sanction such a proceeding, yet that fact, taken in conjunction with the short duration of the Andrenæ in the winged state (together with the fact of a stylopised bee having been found before quitting its cell), would necessarily prevent such a proceeding, the Stylops being so delicately organised as to render the idea untenable, that it could pass so long a period in the winged state as it must necessarily do, supposing its development to take place within the body of the perfect bee alone. Many of the Andrenæ, for example, appear at the beginning of the spring, and remain but a very short period in the perfect state; if, therefore, the development of the Stylops was so rapid as that the eggs should be deposited in, and the perfect Stylops produced from, the Andrena during this short period of its winged existence, it would be necessary, in order to insure the continuance of the race of the Stylops, that such perfect Stylops should survive till the following spring, which is not in the slightest degree probable. The depth of the cells of the Andrenæ under ground, would also prevent the Stylops from making its way to it in order to deposit its eggs in the newly hatched *imago*, *pupa*, or *larva*; whilst Mr. Pickering contends that the apparent want of any oral organs by which the Stylops larva, when hatched, would be able to make its way into the body of the *larva*, is sufficient to disprove the notion that the egg is deposited in the *cell* of the bee, whence he is led to adopt the theory that the Stylops deposits its eggs in the *egg* of the Andrena. This idea is however founded upon the examination of larvæ which had already protruded their heads between the segments of the abdomen of the bee, having arrived

at their full growth, and some of which were even ready to burst forth as imagines; but it is not improbable that the Stylops larva, during its feeding state, may possess more powerful oral instruments, which are subsequently withdrawn, just as is the case with the mandibles of the larva of Diptera.

In such uncertainty, the fact that the sexual distinctions of these insects have not been observed, or, rather, that all the specimens which have yet been examined in the winged state are apparently males (judging from the antennæ and abdominal appendages), together with the circumstance that some individuals remain unchanged at the time when others assume the winged (male?) form, are deserving of consideration; as is also the following observation. In the spring of 1836, whilst keeping numerous stylopised individuals of Andrena Gynnana and parvula, in the hopes of rearing the Stylops, I observed a number of excessively minute hexapod creatures creeping amongst the hairs of the abdomen of the bees (which were evidently much annoyed at their presence), and which, with a strong lens, I distinctly saw making their way through the transverse impression near the extremity of the upper side of the head of the larva of the Stylops* (*fig.* 93. 18.); and in this manner every one of the many larvæ of the Stylops, which I hoped to rear, perished. Anxious, however, to obtain more knowledge of these parasites of the parasite, I opened the bodies of some of the bees thus attacked, so as to expose the moist and fleshy body of the larvæ of the Stylops, when I was surprised to find the latter filled with an extraordinary number of them; some, as though not sufficiently developed, lying in an arched position; and others, nearer the head of the Stylops larva, struggling towards the place of exit above mentioned. The transparent skin of the larva permitting them to be clearly visible, I do not hesitate in stating that there must have been far beyond a hundred of these creatures in each Stylops larva. The body is long and flattened (*fig.* 93. 19. one highly magnified), rather narrow towards the tail, which is furnished with two very long setæ; the head is semicircular and flat, with two dark eye-like patches at each posterior angle, and apparently destitute of antennæ; the body is composed of thirteen segments, including the head, and excluding the two small fleshy tubercles upon which the anal setæ are placed: the first segment of the body is transverse, and applied

* The Senator Van Heyden has observed the same circumstance in Xenos. (*Trans. Ent. Soc.* vol. i. p. lxxiv.)

closely in front to the posterior part of the head, but easily distinguished therefrom; the posterior angles of the remaining segments are terminated by several setæ. The legs are six in number, attached to the lateral under surface of the three anterior segments. These creatures creep but slowly about the head of the larva (*fig.* 93. 18.), and amongst the hairs of the bee's tail, and whilst in motion they have a very peculiar mode of progression.

These little creatures, which exhibit many points of resemblance with the supposed larvæ of Meloe (Pediculus melittæ *K.*), give rise to various queries connected with their economy, which it is difficult to answer, even by analogy. That every Stylops larva should be thus infested to this extent, is in itself singular; but when we inquire, when were these parasites deposited in the body of the *internal*-feeding parasite Stylops larva? upon what will they now subsist? or in what situation will they remain until they are again enabled to place the germs of their progeny in a similar situation in the body of the larva of the Stylops? we are compelled to admit our inability to offer any satisfactory reply. Is it possible that they may be the larvæ of the Stylops in an active form? Such an opinion is opposed by the many apparent anomalies which would attend such a circumstance; but the Strepsiptera are sufficiently anomalous to warrant the proposal of such a question. Coccus, Psyche, Oiketicus, Hippobosca, and Aphis, may all be cited as possessing anomalous habits and modes of development which would exhibit analogies with Stylops, supposing the female Stylops to retain its larva form, and to produce such living young. The impregnation of such a female might easily be effected, although remaining in its fixed position, or the young might be produced for several generations without such an act. I have made some farther observations upon these minute parasites in the *Trans. Entomol. Soc.* vol. ii. p. 186.

Mr. Pickering has given the following list of species of Andrenæ which he has observed to be infested with Stylops: — Andrena nigroænea, A. tibialis, A. rufitarsis, A. labialis, A. fulvicrus, A. Collinsonana? A. Mouffetella, A. varians, A. picicornis, A. parvula, A. Xanthura, A. convexiuscula, A. Afzeliella, and several new species; to which he has added, from my collection, A. Gwynnana. Recent observations have also proved that the allied genus Halictus is also subject to the attacks of species of this order. (St. Fargeau, in *Encycl. Méth.* tom. x. p. 292.) Indeed, Mr. Dale has named one of the genera Halictophagus, on

the bare supposition that it infests Halictus, the type H. Curtisii having been found in company with the males of Halictus æratus, on the 15th of August, in one of which he found a pupa exactly at the apex of the abdomen. (See Dale, in *Mag. Nat. Hist.* July 1830.) The genus Xenos is restricted to the wasp genus Polistes, X. vesparum (Rossii *K.*) attacking P. gallica, and the American X. Peckii infesting P. fuscata. Rossi also mentions Vespa sexfasciata, and some other more minute species, as infested with a similar foe. Mr. Kirby found exuviæ in V. concolor, an exotic species of the restricted genus Vespa. (Sowerby, *Brit. Miscell.* 45.) The Senator Van Heyden has observed a new species of Xenos, in which the branches of the antennæ are of unequal length, in Polistes gallica, and another species much smaller than X. Rossii, in a species of Odynerus (O. auctus?). M. Van Rozer had also observed the larva of a species of this genus in the body of Vespa vulgaris. (*Trans. Ent. Soc.* vol. i. p. lxxiv.) Mr. Shuckard also possesses other exotic species of wasps similarly infested. Mr. Templeton found a specimen of Elenchus tenuicornis (Walkeri?) in his net, in which he had placed the nest of a Bombus, whence he thought it probable that it was parasitic on that genus; but having discovered another species in the Mauritius, where the genus Bombus does not occur, he is now inclined to doubt his former opinion. (*Trans. Ent. Soc.* vol. i. p. 174.) The Mauritian species he considers to be probably parasitic upon a species of wasp (Polistes?) which is frequent in that island. M. L. Dufour has also observed a larva, evidently of one of these insects, with the head exserted between the abdominal segments of one of the Fossorial Hymenoptera, Ammophila sabulosa (*Ann. Sci. Nat.*, Jan. 1837, p. 19.); and Mr. R. Templeton captured a species of Sphex at Rio Janeiro, from the abdomen of which he extracted a new species of Xenos, which he has named X. Westwoodii, and of which he has forwarded a detailed description and figures to the Entomological Society of London.

The species seem widely distributed, although, from their minute size, they have hitherto escaped the observation of collectors abroad. The genus Stylops, of which there appear to be many species (of which sufficient comparative characters have not yet been given), has hitherto been found only in England, if we except S. Childrenii *Gray*, discovered in a North American bee; Xenos occurs in the middle and south of Europe, and in North America; X. Westwoodii was found in a Brazilian Sphex; Elenchus in England, as well as in the island of Mauritius; R. Templeton having captured many specimens of an

extremely minute species, in his sweeping-net, in that island, and which I have described under the name of El. Templetonii (*Trans. Ent. Soc. Lond.* vol. i. p. 173. pl. 17. f. 15.); and R. H. Lewis informs me in a recent letter that he has captured a Stylopized bee in Van Diemen's Land. Halictophagus has hitherto only occurred in England; indeed, English entomologists may justly be proud of the great share which they have had in extending our knowledge of the limits of this singular tribe of insects.

These insects appear at different times of the year. The majority of the individuals of Stylops have been found in the beginning or middle of the spring, as early as the middle of March, until the middle of May, which is owing to the species of Andrenæ, which they infest, bursting forth at that time. Mr. Pickering's discovery of one in the body of a bee which had not quitted its cell, in the month of December, shows that the appearance of the Stylops is synchronous with that of the Andrena. Xenos Vesparum, according to Rossi, comes forth in August and September. The specimens of Elenchus tenuicornis *K.* have been captured in June and July, and beginning of August, by sweeping grass; and Halictophagus Curtisii on the 15th of August.

It is exceedingly difficult to speak with decision as to the relations of this order. Rossi, the first observer of one of the species, regarded it as Hymenopterous, "Insectum novi generis Ichneumoni proximum." Mr. Kirby at first considered that, from its mode of life, it ought also to belong to that order, and to the genus Ichneumon, although so greatly differing from its characters; whilst, from its elytra, it ought to be Coleopterous, although possessing little of the general habits of that order; adding, "Perhaps it had better be considered as Hemipterous" [in the Linnæan sense including the Orthoptera *Oliv.**]; "but, till an opportunity occurs of examining more specimens, it would be rash to speak too positively upon this head." (*Mon. Ap. Angl.* vol. ii. p. 112.) In his more detailed memoir, published in the *Linnæan Transactions*, Mr. Kirby observed that, "With respect to the place of Strepsiptera in the system, it seems to me that this order should follow Coleoptera; for its metamorphosis being different from that of Orthoptera and Hemiptera, and nearer to that of Coleoptera, this seems its most natural situation, considered as an elytrophorous order." (*Op. cit.*

* Mr. Haworth thought it as allied, but remotely, to those Cimices whose scutella cover the abdomens. (*Trans. Ent. Soc.* 1807, p. 60.)

vol. xi. p. 108.) Lamarck placed it amongst the Diptera. Latreille places it between the Lepidoptera and Diptera, observing that, in a natural system, they should immediately succeed Eulophus, and other parasitic Hymenoptera. Jurine regarded it as intermediate between the Hymenoptera and Diptera. Mr. MacLeay, combining the opinions of Kirby, Latreille, and Jurine, places the Strepsiptera between the Coleoptera and Hymenoptera, as an osculant order. (*Horæ Ent.* p. 425.) It would occupy far too great a space to review the grounds upon which these various relations are supposed to rest; and which are founded, indifferently, upon structural, metamorphotic, or economic considerations. I cannot, however, but observe, that whilst the mouth appears to me to present the greatest analogy to that of the Lepidoptera, the nature of the transformations is much nearer that of the coarctate Diptera (although the head of the larva does not appear to be of variable form), some of which are also equally entomobious. The branched antennæ of Eulophus, or the longitudinally folded wings of Leucospis, offer but very slight grounds of support (in addition to the parasitic habits of these genera) to the supposed relation of the Strepsiptera and Chalcididæ; whilst, at the same time, the whole structure of these insects in the imago state removes them from the Diptera, whereas it must be admitted that, in respect to the general structure of the body (and by adopting the view given above of the thoracic segments and nature of the alary appendages), the Strepsiptera are intermediate between such Coleoptera as Atractocerus, and such Orthoptera as Phasma.

The order consists of only a single family, Stylopidæ *Kirby.**

Order LEPIDOPTERA† *Linn.* (*Glossata* Fabr.)

Char. Wings four, large, extended, membranous, covered on both sides with minute imbricated scales; often connected together by a hook and bristle; neuration branching.

† Bibliogr. Refer. to Lepidoptera in general.

A. *General Lepidoptera of all Countries.*

Cramer. Uitlandsche Kapellen, &c. 4 vols. 4to. Utrecht, 1775–82, with a supplementary volume by Stoll.

Mouth with rudimental labrum and mandibles; maxillæ antliate, sometimes with minute palpi; labrum rudimental, with two large labial palpi.

Tibiæ spurred; anterior with an inner spur.

Thorax forming an ovate mass; prothorax very small, furnished with a pair of patagia; mesothorax largest, with a pair of large tegulæ.

Pupa obtected.

Clerck. Icones Insectorum variorum. 4to. Holm. 1759-64.

Martyn. Psyche, or Fig. of Exotic Lep. Ins. 4to. London, 1797, 32 pl.

Fabricius. Systema Glossatorum, abstract in Illig. Mag. vol. vi. 1807, and translated by Children in Taylor's London and Edinb. Phil. Mag. Feb. 1830.

Esper. Die Schmetterl. in Abbildung. &c. 6 vols. 4to. Erlang. 1777, &c. (5 vols. of European, and 1 vol. of Exotic species).

Herbst. Natursyst. der Schmetterl. 7 vols. 8vo. Berlin, 1783–95. — Ditto, Natursyst. aller bekannt. Insect. 8vo. Berlin, 1783–95, 10 vols. (4 occupied with Lepidoptera).

Geyer. Zutrage zur Samml. Exotische Schmetterl. 5 Centuries, 1838.

Boisduval. Hist. Nat. Ins. Lepid. (Suites à Buffon) tom. i. Paris, 1836.

Giorna. Account of a singular Conformation in the Wings of Moths, Trans. Soc. Linn. vol. i.

Poey. Observ. sur le Crin des Lepidopt., Ann. Soc. France, 1832.

Van der Hoeven. Sur les Crochets des Ailes dans les Sphinx, &c., in Bijdragen tot d. Naturk., &c. tom. ii.

Tiede. Ueber die Augen der Raupen (Neu. Mannigfaltigkeit, 1 Jahrg. 129.).

Savigny. Upon the Mouth of Lepidopterous Insects, in Bull. des Sci. tom. xiv., and Bull. Soc. Philomat. 1814.

Herold. Entwickelungsgesch. der Schmetterl. Anatom. u. Physiol. 4to. Cassel und Marburg, 1815, with 33 pl.

Bonnet. Disquisitiones circa Respirat. Erucarum, Mém. Acad. Paris, tom. v.

Bernouilli. Observationes de quorundam Lepidopt. Facultate Ova sine prægresso Coitu fœcunda excludendi, in Nouv. Mém. de l'Acad. Berlin, 1772.

Bernard Deschamps. Recherches Microscopiques sur l'Organization des Ailes des Lepidoptères (Ann. Sci. Nat., n. ser., tom. iii.).

Reid. On ditto, in Taylor's Lond. and Edinb. Phil. Mag. October 1839.

B. *British Lepidoptera.*

Haworth. Prodromus Lepid. Britann. 4to. Holt. 1802 (anonymous). — Ditto, Lepidoptera Britanniæ. 8vo. London, 1803–28, in four parts.

Wood. Index Entomologicus, or a complete illustr. Catal. of Lepid. of Great Britain. London, 8vo. 1833–38.

Petiver. Papilionum Britanniæ Icones Nomina, &c. fol. Lond. 1717.

Wilkes. The English Moths and Butterflies. 4to. 120 pl. London, 1747–60.

Harris. The English Lepidopterist. 8vo. 1765. — Ditto, The Aurelian. fol. 1766. — Ditto, An Essay, wherein are considered the tendons, &c. 4to. Lond. 1767.

The present order, comprising the numerous and beautiful tribes of butterflies and moths, derives its Linnæan name from λεπις, a scale,

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Jermyn. The Butterfly-Collector's Vade Mecum. 12mo. Ipsw. 1824.

Martyn. The Aurelian's Vade Mecum. 12mo. Exeter, 1785.

Albin. A nat. Hist. of English Insects. 4to. Lond. 1720 (6 editions).

Brown's Book of Butterflies, in Constable's Miscellany.

Duncan, in Jardine's Naturalist's Library, 3 vol.

C. *European Lepidoptera.*

Ochsenheimer and Treitschke. Die Schmetterl. von Europa. 14 vols. 8vo. Leipzig, 1807–34; with three supplementary volumes. An abstract of this work, as far as the Geometridæ, published by Children in Taylor's London and Edinb. Phil. Mag, 1830.

Treitschke. Hülfsbuch für Schmetterl. Samml. 8vo. Vienna, 1834.

Borkhausen. Naturgesch. Europ. Schmetterl. 8vo. Frankfort, 1788–94.

Freyer. Beitr. aus d. Taschenb. mein. Europ. Schmett. Augsb. 1827–30. — Ditto, Neuer Beitrage. Augsburg, 1831.

Lucas. Hist. Nat. Lep. d'Europe. Paris, 8vo. 1832.

Buhle. Die Tag und Abendschmetterlinge Europa. Leipzig, 1837, 4to. with 8 pl. — Raupen und Schmetterlings Kalendar. Leipzig, 1837, 4to. with 1 plate.

Godart. Hist. Nat. des Lepidopt. de France. 5 vols. 8vo. Paris, 1821; continued by Duponchel in 4 more vols.

Duponchel. Supplement to ditto, 1832, in livraisons. 8vo. Paris. — Ditto, Iconogr. des Chenilles, 1832, in livraisons. 8vo. Paris.

Boisduval. Europæorum Lepidopt. Index Methodicus. 8vo. Paris, 1829. — Ditto, Icones Historiques des Lepidopt. Nouv. 8vo. Paris, 1833, in livraisons. — Ditto (with Rambur and Graslin), Collect. Iconogr. et Histor. des Chenilles. 8vo. Paris, 1833, in livraisons.

Villiers and Guenée. Tableaux Synoptiques des Lepid. d'Europe. Paris, 1835.

Duponchel. Catal. de Lepidopt. de la Lozère, in Ann. Soc. Ent. France, tom. iii.

Rambur. Notice sur plusieurs Lepidopt. du Midi de la France, in Ann. Sci. Observ. tom. ii. 1829, and Ferussac Bullet. 1829, and Ann. Soc. Ent. Fr. 1836. — Ditto on Spanish Lepidoptera, in Ann. Soc. Ent. Fr. 1836, and in his Faun. Entomol. Andal.

Graslin on Andalusian Lepidoptera, in Ann. Soc. Ent. Fr. 1836.

Merian. De Europaische Insecten. Amsterdam, 1730, 4to. Erucarum Ortus, &c. 1747, 4to.

Dennis and Schiffermüller. Verzeichniss der Schmetterlinge der gegend Wiener. Vienna, 1775. — Ditto, edited by Illiger and Hafeli. 2 vols. Brunsw. 8vo. 1801

Charpentier. Die Zinsler Wickler, &c. des System. Verz. der Schmetterl. der Wiener gegend. 8vo. Brunswick, 1821.

Laspeyres. Kritische Revision des Syst. Verz. Schmett. Wien., in Illiger's Mag. band ii. and iv.

Hubner. Beytr. zur Gesch. der Schmett. 2 vols. 8vo. Augsb. 1786–90. — Ditto, Samml. Europaisch. Schmetterl. Augsb. 1805. — Ditto, Gesch. Europaisch. Schmetterl. 4to. Augsb. 1806 (containing the Transformations, and

and πτερα, wings; those organs furnishing, as usual in the Linnæan classification, one of the chief characteristics of the order, and consequently its name.

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continued by Geyer). — Ditto, Systemat. Alphabet. Verzeichn. Europ. Schmetterl. 8vo. Augsb. 1826.

Hoffmansegg. Erst. Nachtr. zu Verzeichn. von Hubner's Schmett. in Illiger's Magaz. 5 band.

Pezold. Lepidopt. Anfangsgrunde Coburg, 1796, 8vo. with pl.

Sepp. Beschouwing der Wonderen Gods, &c. 5 vols. 4to. Amsterdam, 1760. 1834.

L'Admiral. Naauwkeurige Waarneemingen, &c. folio, 1740-62, 33 plates.

Lier et Duval. Collect. des Lepid. des Pays Bas. 8vo. tom. i. 1827.

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Schneider. System. Beschr. der Europ. Schmett. Halle, 1787. — Ditto, Lapländische Schwedische Schmetterl., in his Entomol. Magaz. vol. i.

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Muller, C. L. V. Lepid. Silesica. Breslaw, 1773. — Ditto, Faun. Lepid. Silesiaca. 1802. — Fauna Lepidopt. Silesiaca. Breslaw, 1802, 2 hefte.

Meigen. System. Beschr. der Europ. Schmetterl. 4to. Aix-la-Chapelle, 1828, in parts.

Boie. On Danish Lepidoptera, in Kroyer's Nat. Hist. Tidskr. heft v. vi.

Prunner. Lepidopt. Pedemontana. 8vo. August. Taurin, 1798.

Battista Repatta. List of Lepidopt. Larvæ, in Italian, 1793 (in Brit. Mus.).

Schott. Raupenkalendar. Frankfort, 8vo. 1829. — Schmetterlings Kalendar, u. Syst. Verz. Schmetterl. Deutschl. 8vo. Frankfort, 1830.

Vogel. Chronologische Raupenkalendar. Berlin, 8vo. 1834, 41 col. pl.

Eversmann. Enumeratio Lepid. Fluv. Volgau et Montes Ural., &c. Bull. Soc. Nat. Moscow, tom. iii. — Ditto, Lepidopt. Species Orenburg, &c., Mém. Soc. Nat. Mosc. tom. viii. — Ditto, in ditto, 1837.

Ernst and Engramelle. Insectes de l'Europe (Lepidopt.). 4to. 8 vols. 1779-93.

Hegeer. Beitrage zur Schmetterlingskunde Sicilianisch. Wien, 1838, 4to.

Keferstein. Observ. sur l'Apparition des Lepid. (various notices in Silbermann, Rev. Entomol. tom. ii.).

De Selys Longchamps. Catal. Lepidopt. de la Belgique. Liege, 1837, 8vo.

Schaffer. Nomenclator Entomologicus. heft i. Regensberg, 8vo. 1834.

Leiner. Katalog Lepidopt. in Umgebung v. Constanz, in Isis, 1829.

Rambur. Catal. Lepid. de l'Ile de Corse, in Annal. Soc. Ent. France, tom. v. p. 1, 2.

Thon and Schenk. Fauna von Thuringen, band iv. Schmetterl. Jena, 1837.

Sodoffsky. Lepid. Livoniæ Observ., Bull. Soc. Imp. Mosc. tom. i. 1829. — Ditto, in ditto, 1837, several articles upon Russian Lepidoptera.

Kollar. Cat. Systémat. Lepidopt. Austria, in tom. ii. Mém. States de l'Autriche, 1832. Vienna, 8vo.

D. *Extra-European Lepidoptera.*

Lefebvre. Descript. de quelq. Lépidopt. Noct. Hyperboréens, in Ann. Soc. Ent. Fr. 1836.

The number of these insects is very great, nearly equalling any of the other orders, with the exception of the Coleoptera; thus, Dr Burmeister supposes them to amount to not fewer than 12,000, or nearly one sixth of the whole of the insect tribes; and Stephens describes nearly 2000 species, or nearly one fifth of our indigenous insects. The number of exotic species is probably even greater, considering the greater share of investigation which has been given to the more minute species of the order in this country* than on the Continent, whence we may infer that much still remains to be done. Amateurs enough are to be found, both at home and abroad, who content themselves with collecting and describing the more showy and larger

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Merian. Metamorph. Insect. Surinamens. Amsterdam, 1705, fol. with 60 color. pl. (various other editions.) — Review of ditto, by L. Guilding, in Mag. Nat. Hist. July, 1834.

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Horsfield. A Descriptive Catalogue of the Lépidopt. Insects contained in the Museum of the East India Company. London, 4to. 1828–29, 2 parts.

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Menetries. Observ. sur quelq. Lepid. du Bresil, in Mém. Soc. Natur. Mosc. tom. vii.

Poey. Centurie de Lepidopt. de l'Ile de Cuba. 8vo. Paris, 1832.

Wienker. Lepid. Nov. Mus. Berol. 4to., edited by Klug, part i. 1837.

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Lewin. Prodromus Entomology, or Nat. Hist. of Lepid. of New South Wales, 4to. London, 1805 (18 pl.).

Boisduval. Faune Entomol. de Madagascar, &c., Lepidoptera. Paris, 8vo. 1832. (Voyage de l'Astrolobe.) — Ditto, in Nouv. Ann. du Museum, tom. ii.

And the general works of *Linnæus, Fabricius, Römer, Rösel, Shaw, Drury, Donovan, Palisot Beauvais, Sulzer, De Geer, Lyonnet, Panzer, Guérin, Klug,* (*Ehrenberg,*) *Perty, Latreille,* (*Humboldt,*) *Griffith, Stephens, Curtis, the Encyclopédie Méthodique, Bouché* (Naturgeschichte, containing descriptions of numerous larvæ and pupæ), &c.

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* A recent continental reviewer has expressed his astonishment that so great a proportion of Wood's *Index Entomologicus* should be occupied with the minute Lepidoptera. "Vorzuglich die Microlepidopteren sind mit Vorliebe und Geschicklichkeit behandelt, und sie allein füllen über die Hälfte des Werke, da sie von den Pyraliden ab mit dem eilften Hefte beginnen." Germar's *Zeitschr für die Entom.* vol. i. p. 351. 1839.

species of the order, but the minute species have been much neglected even by professed Lepidopterists; whilst the principles of the classification of the order, and the philosophical investigation of the characters of the species in their different states, have been almost entirely neglected by the majority of writers; thus even in the most elaborate works hitherto published, such as the *Weiner Verzeichniss* and Dr. Horsfield's *Lepidoptera Javanica*, we find so important a character as the neuration of the wings entirely overlooked; and in the still more recent work of Boisduval, the neuration of the wings, and the preparatory states, are alone considered as of importance. Under such circumstances, therefore, it is not surprising that the natural arrangement of the entire order has still to be effected, and that Latreille's observation, "Lepidopterorum ordo entomologorum scopulus; horum insectorum etenim instrumenta cibaria simplicia; antennæ pro sexu diversæ; metamorphoses permultorum nobis ignotæ; idcirco nepotes nostri methodum optimam soli conficient" (*Genera Crust., &c.* vol. iv. p. 186.), is as correct as when it was written, thirty years ago. Materials are, however, accumulating upon our hands, which will lighten the difficulties of the task by degrees; thus, whilst Sepp, Lyonnet, Harris, Hubner, Horsfield, Stoll, Lewin, Abbot, and others have investigated the metamorphoses of many species of Europe, Java, South America, New South Wales, and North America, Curtis and Horsfield have investigated the structure of various external parts of the imago, and Lyonnet, Herold, and Newport have most laboriously detailed the internal anatomy of the goat moth, cabbage butterfly, and privet hawk moth in all their stages.

The imago state is characterised by several peculiarities not occurring in any of the other orders. The body is compact, and densely clothed with hairs or scales; the head is free, not being received into a frontal prothoracic cavity, but attached by a narrow ligament; it is furnished at the sides with a pair of large granulated eyes *, and its hinder part often with a pair of ocelli, which are generally hidden by the thick covering of hairs or scales: the antennæ are inserted on the upper part of the head, and are generally long and multiarticulate, very variable in form, and often very complicated in the males; the

* The number of facets in the eyes of these insects varies considerably: thus, in the silkworm moth there are 6236; in the goat moth 11,300; in the eye of one species of butterfly 17,325; or 34,650 in both eyes, according to a calculation by M. Puget, quoted by Geoffroy. (Hist. abr. Ins. vol. i. p. 4.)

mouth, at first sight, appears to consist of a long and delicate spirally convoluted organ, which, when examined, is found to consist of two pieces, each of which is sometimes provided with a small jointed appendage or palpus at its base. This very slender proboscis * (spiritrompe, or spirignatha, as it is called by Latreille, or antlia by Kirby and Spence) is employed to pump up the nectar of flowers, upon which alone it subsists, into the mouth and stomach of the insect, and which, from its peculiar construction, is admirably adapted for penetrating to the depths of the narrowest blossoms. When at rest, it is coiled up, and defended by two large and compressed palpi, composed of three joints inserted upon a fleshy piece, soldered to the front of the head. The peculiar structure of this instrument had been long described by Swammerdam, Réaumur, and others; but it was to the philosophical acumen of Savigny that we are indebted for a clear demonstration of the real nature of these parts, and a knowledge of the existence of all the organs of a mandibulated mouth in the oral apparatus of a butterfly, modified, indeed, as may easily be supposed, to such an extent, that the author who describes two minute fleshy organs, wide apart, and placed above the base of the spiral apparatus as mandibles, the two pieces of which the proboscis is composed as a pair of maxillæ, and the piece soldered flatly to the front of the head as the lower lip, is liable to be treated with ridicule, although the situation of the various parts, and especially the position of the palpi, proves them to be strictly analogous to the several organs observed in the true mandibulated insects. The change, indeed, which these organs undergo in the passage from the caterpillar to the perfect state is most singular: in the mouth of the former, for instance, the upper lip and mandibles are well developed, the mastication of leaves being chiefly performed by the latter organs, whilst the maxillæ and lower lip are small and fleshy organs, the maxillary palpi minute, but distinct, the labial palpi almost obsolete, and the labium terminating in a spinneret; whereas, in the imago every one of these organs is in an exactly opposite degree of development: the upper lip and mandibles, it is true, exist (as in *fig.* 95. 4. a, mandible, b, labrum), but in so rudimental a state as not to be of any use in feeding, whilst the maxillæ and the labial palpi are enormously developed

* Fabricius, who named the Dipterous insects Antliata, gave the name of proboscis to their mouth, and applied the name of lingua to the mouth of the Lepidoptera, although in strictness it ought only to be applied to a single organ of the mouth.

(*fig.* 95. 3. head of Pap. Machaon sideways, with the spiral maxillæ partly unfolded; 95. 4. c, base of maxillæ; 95. 5. f, labium; g, base of labial palpus, and d, rudimental maxillary palpus at the base of the maxillæ; 95. 6. labium detached, with one of the labial palpi). Some Lepidoptera, however, take no food in the perfect state, and their mouth organs are accordingly almost atrophied; this especially takes place amongst the Bombycidæ, where, as in *fig.* 105. 2., the maxillæ (one of which, the left, is alone represented) are so much reduced in length as to be useless, although the labial palpi (*fig.* 105. 1. 3.) are of considerable size (their place of insertion in *fig.* 2. is indicated by the two ovals at the base of the maxillæ). In the Hepiali, however (*fig.* 104. 12.) the labial palpi are even obsolete, and in the emperor moth (*fig.* 105. 4.), the mouth organs are only indicated by minute fleshy tubercles arranged in a circular space in the middle of the under side of the head. In the genus Aglossa, as the name implies, the mouth is described (but erroneously) as being obsolete. Corresponding variations of course occur in the development of the digestive organs of the imago: thus, in some of the typical Sphingidæ in which the spiral apparatus attains its greatest length, nearly equalling that of the entire body, the stomach is scarcely smaller than it is in the pupa state (Newport, in *Phil. Trans.* 1834, vol. xiv. figs. 12, 13. *c, d.*); whereas, in the Dendrolimus pini, in which the parts of the mouth are atrophied, with the exception of the labial palpi, the stomach is almost obsolete. (Suckow, *Anat. Physiol. Untersuch.* tab. 2. f. 10. *b.*) Of the lower parts of the mouth, the labial palpi are those which are most rarely effaced: next to these are to be mentioned the maxillæ themselves; the maxillary palpi being often obsolete, even when the maxillæ are at their highest state of development. Thus in Papilio Machaon, Cynthia cardui, and Sphinx celerio, these palpi are scarcely discernible; whereas in Zygæna scabiosæ they are more distinct (*fig.* 103. 10.), and still more strongly in Galleria, Crambus, and some other of the minute Lepidoptera. (Savigny, *Mém. sur les Anim. sans Vertèbres*, fasc. 1. pl. 1, 2, 3.) In Lampronia, Euplocamus, and some others figured by Curtis, they are still more elongated, considerably exceeding the maxillæ themselves in length.

The thorax is robust and compact, the prothoracic portion minute, owing to the fore legs performing no supplemental functions, whilst the mesothorax, to which is attached the anterior pair of large wings,

is greatly enlarged, the metathorax being again reduced in size. The prothorax bears upon its upper side a pair of organs, especially characteristic of the order, namely, a pair of scales covered with hair quite distinct from the wing-covers (tegulæ), which Kirby and Spence call patagia or tippets, but which have been overlooked by all other authors except Chabrier, who first discovered them, or else confounded them (as by Burmeister, *Translation*, p. 77.) with the true tegulæ: they are described as vesicles appearing full of liquid and of air, and are placed at the sides of the pronotum (*fig.* 105. 6., being the two transverse oval parts figured in the transverse piece succeeding the head); the prothorax is often differently coloured to the remainder of the thorax: thus, in the large Papilionidæ, it is marked with conspicuous red spots. The mesothorax is furnished at the sides with a pair of large triangular scales called pterygodes by Latreille, paraptera by MacLeay, or tegulæ by Kirby and Spence, affixed at the base of the anterior wings on the upper side, often clothed with hairs of a different colour to the rest of the mesonotum (as in Arctia villica). The form of these organs is very variable, giving to the thorax a diversity of appearance: thus, in the genus Cucullia (belonging to the family Noctuidæ), they are very large, and the thorax is pushed forwards, forming a sort of hood over the head; whilst, in Xylina, they are more elongated, and give to the sides of the thorax an elevated appearance, with the centre depressed. In *fig.* 105. 6., the right parapteron is shaded with longitudinal lines, the left one being removed to show the mesothoracic spiracle. The scutellum of the mesothorax occupies the hind part of this segment. The metathorax is a shorter transverse piece composed of an anterior and posterior piece, with two lateral ones of a triangular form, the apices of which meet in the middle of the metanotum. This part is dotted in *fig.* 105. 6.; its small anterior portion I have considered as the præscutum of the metathorax, the two lateral pieces as conjointly forming the scutum and the posterior part as the scutellum. (Griffith, *An. Kingd.* pl. 121. three upper figures, Saturnia pavonia major.) The segment immediately following this dotted portion has a membranous wrinkled appearance in Cossus ligniperda (Lyonnet, *Posth. Mém.* pl. 46. f. 4. segment 4.), which might lead to the idea that it was analogous to the semicircular membrane represented in my *fig.* 72. 1. and 2.†, and considered (p. 92. note *anté*) as analogous to the funiculus of the petiolated species; but on examination of other

species, especially Saturnia pavonia major, I have found this piece to be of a similar consistence with the other abdominal segments.

The wings are attached to the lateral and superior parts of the meso- and meta-thorax, and are always present, except in a few species, of which the females alone are apterous, or have the wings reduced to small and useless appendages: these wings are of large size, and are not folded up *; the two fine layers of membrane of which the wings are composed, like the upper and lower surface of a leaf, are kept expanded by a number of longitudinal corneous veins, or nerves, as they have been called, but which Dr. Leach termed Pterygostia, or wing-bones. These veins here as in the Diptera and Hymenoptera, according to their number and position, offer very important characters for generic distribution, but which have been too much neglected by Lepidopterists. M. Boisduval, in his recent work, has delineated these nerves in many of the genera of butterflies; although it is but proper to observe in justice to our own countrymen Harris and Jones, that they long ago published observations on this subject, the latter in the 2d vol. of the *Linnæan Transactions*, in which the same subject was well treated. The wings in this order offer another peculiarity, since, instead of being naked and transparent, they are clothed with a double layer of minute scales, somewhat resembling those of fishes. These scales, upon which the beauty of these insects so entirely depends, are easily detached in the form of a fine dust, and, when examined under the microscope, are exceedingly variable in their form, but generally more or less wedge-shaped, or oval; sometimes toothed or notched at the broadest end, and having a slender point at the base, by which they are attached upon the membranous surface of the wing, which, when denuded, presents the appearance of numerous minute impressions arranged in lines, in which the base of the scales are planted, being laid upon each other like the tiles on the roof of a house (*fig.*105. 5.). Lyonnet, in his posthumous memoirs, has filled several quarto plates with representations of these scales, varying to almost every form, taken from the wings and body of the goat moth, so that the suggestion of a writer (*Mag. Nat. Hist.* No. 11.), that the form of these scales might be used for specific characters, is entitled to no weight. Some species have a double layer of these scales on both sides of the wings, the under layer usually consisting of white scales. The number of these scales is very great, there being more than

* The Pterophori offer a partial exception to this rule.

400,000 on the wings of the silkworm moth according to Leuwenhoeck: in some species, however, the wings are partially, or even entirely, denuded of scales; and in others, small patches only are thus denuded, as in the great atlas moth. In many species, these scales exhibit the most brilliant metallic tints, so that in the bright light of the sun it is almost impossible to look upon them: such is especially the case with the splendid blue Brazilian species of Morpho: others, again, have the under side of the wings ornamented with beautiful silvery spots, occasioned, according to Kirby and Spence (*Introd.* vol. iii. p. 652.), by the high polish of their surface, and the purity of the white colour of the scales, contrasted with the dull opake colour of the wings. It is only very recently that the surface of these scales has been microscopically examined with the view of ascertaining the mode in which the beautiful colours which they exhibit is produced. M. Bernard Deschamps has especially investigated these parts, which he has found to differ, not only in the granulations and striæ with which their surface is covered, but also in the number of the membranes of which they are composed, having arrived at a knowledge of the latter curious circumstance, from the scales being occasionally imperfect in certain parts, giving an opportunity of investigating them more perfectly than when entire: hence he is induced to consider that all these scales are formed of two or more commonly, of three lamellæ; and it is always upon the superior layer that the granulations, of which the colouring matter of the scale is composed, are to be found: these granulations are of a regular form, and their number is sometimes so considerable, that the scale is entirely opake; when it exhibits striæ, it is always upon the second lamella that they are placed. These striæ are often parallel, and formed of rows of minute granulations, like oval or round pearls placed end to end. Those scales which have striæ without granulations, have only two lamellæ; the inferior surface of the second (when only two), or the third lamella in almost all the diurnal, and some nocturnal species, has the property to reflect prismatic colours more intense and beautiful than those on the upper surface, which give the colour to the wing. The scales which ornament the splendid metallic blue and green butterflies have the surface differently constructed from those of any of the others. M. Deschamps has also described some singularly formed scales, peculiar to the males of certain species of butterflies, which he terms "plumules." The species which possess them belong to the genera Pontia, Hipparchia, and

Polyommatus. Some of these are of a reversed heart shape, with a thin peduncle arising between the two basal lobes, the apex being terminated by numbers of minute filaments often thickened at the tip. M. Deschamps has also made an extensive series of observations upon the manner in which these scales are implanted into the membrane of the wing, and has shown that the firmer fixing of them in the Bombycidæ is owing to the base of the peduncle being clavate, and inserted into a similar-shaped cup. (*Annal. Sci. Nat.* February 1835. pl. 3, 4.)

Mr. Bowerbank has also subjected the scales of several species of butterflies to a similar investigation, with a nearly similar result, considering that the scales consist of at least two distinct layers; the uppermost formed of numerous longitudinal and cross striæ, covered or connected by a thin membrane more or less coloured, and the under one composed of a somewhat thicker and stronger membrane, of uniform texture, and without striæ. The greatest breadth of the dark brown scales from the wing of Papilio Paris is but $\frac{1}{345}$ of an inch; the quill by which it had been attached to the wing is $\frac{1}{3000}$; the distance of the striæ from each other, $\frac{1}{15151}$; and the diameter of the longitudinal striæ themselves, $\frac{1}{27777}$ of an inch. These striæ Mr. Bowerbank seems to regard as canals. The internal diameter of these minute tubes, supposing them to be such, may be estimated at about $\frac{1}{83331}$ of an inch. (*Entomol. Mag.* No. 23. p. 304.) See also Read, in Taylor's *London and Edinb. Phil. Mag.* for October 1839.

The variations in the colours and markings of the wings are almost as numerous as the species themselves: the sexes also often differ materially from each other; still some general principles are evident in the distribution of these colours and markings. Thus the Pontiæ and Pierides are almost uniformly white; Colias and its allies yellow; the Fritillaries rich brown, spotted with black and with silvery spots on the under side; Hipparchia and its allies ornamented with eye-like marks; the Lycænæ copper-coloured; the Polyommati fine blue, with small eyes on the under side; the Zygænæ with red under wings; the Noctuidæ with an ear-like mark in the middle of the fore wings; the Geometridæ with waved carpet-like marks.

Another peculiarity consists in the apparatus by which the two wings on the same side are retained together in the same line during flight, composed of a loop, in which a strong bristle plays (*fig.* 102. s.): the

loop is formed either by an elevated portion of the membrane of the strong central vein of the upper wing on its under surface, or by a little tuft of raised hairs. This appears to have been first noticed by De Geer (tom. i. tab. x. f. 4.) and Harris (in his essay upon the membranes of the wings), and afterwards by Giorna (*Linn. Trans.* vol. i. p. 135.) in greater detail. M. Poey (*Ann. Soc. Ent. France*, tom. i.) has observed that the bristle is simple in the males, but multiplied in the other sex; in which, however, according to Kirby and Spence, there is no annulus, and consequently these individuals are less fitted for flight. See also Hoeven, in *Ferussac. Bull. Sci. Nat.* March 1828. It is chiefly amongst the Sphingidæ and moths that we find this apparatus, the butterflies being destitute of it.

The legs of these insects are long, slender, and hairy, offering, in various species, remarkable peculiarities in the opposite sexes, which have not been sufficiently studied. In general the six legs are alike, or nearly so; but in some butterflies the fore legs are minute and rudimental. The posterior tibiæ are often furnished with two pair of spurs, namely, a pair at the apex, and another pair below the middle, on the inside. This is the case in all the nocturnal and some of the diurnal species (forming the family Hesperiidæ); whereas the remainder of the butterflies have only one pair at the apex of the posterior tibiæ. The ungues are variable in form, being sometimes bifid. In some butterflies, also, they are attended by several curious appendages, which have been more particularly described by M. Doyère (*Ann. Soc. Ent. France*, 1837), and figured in the new edition of the *Règne Animal*, published by Crochard. The abdomen is cylindrical, and destitute of a sting; although Dr. Burmeister has noticed an exotic species, in the Royal Museum at Berlin, which appeared to be provided with an instrument of this kind, but which I should be inclined rather to regard as the acute extremity of the ovipositor, which, in many species, whose larvæ are subterraneous or subcortical in their habits, is long and acute.

Owing to their large size and the greater degree of attention which has been bestowed upon these insects, a far greater number of instances are on record of monstrosities, produced either from accidental circumstances in the individual, which is otherwise perfect (as variation in size, colour, or markings), or from that imperfect species of hermaphroditism which has been termed gynandromorphism, in which one individual exhibits portions of the markings or structure of both

sexes. Burmeister, Lefebvre, and Lacordaire have enumerated a considerable number of such instances. *

There is often very considerable diversity in the appearance of the sexes of these insects, the females being generally the largest, most dully coloured, with simple antennæ: they are occasionally also destitute of wings (as in Orgyia, Cheimatobia, Lampetia, &c.), and even in Oiketicus and Psyche present but very little of the appearance of perfect insects, bearing a much greater resemblance to full-grown larvæ. In some species, also, the opposite sexes are coloured, either entirely or partially different from each other, as in the ghost moth, muslin moth, or orange-tip butterfly, the female of which last has not the slightest tinge of orange on its wings. Another curious sexual diversity takes place in some of the Geometridæ, the males of which have a large wing-like lobe at the base of the posterior wings, giving them the appearance of being six-winged (Lobophora sexalisata, &c.).

The transformations of these insects have attracted the attention of observers from the earliest times, owing to their common occurrence, large size, and the beauty of the insects in their perfect state. The eggs are far more variable in shape than in the other orders, their surface being often elaborately ornamented with raised lines, spots, &c., in many cases closely resembling Echini. The larvæ, which are commonly called caterpillars, are long and cylindrical, composed of thirteen segments, of which the anterior represents the head of the imago, and is succeeded by three segments, each of which mostly bears a pair of simple, short, and articulated feet. These segments represent the thorax, and the remainder the abdomen, of the butterfly or moth. Of these segments, the four intermediate ones, as well as the anal segment, are furnished with prolegs, as they have been termed, being thick, short, fleshy limbs, armed at the extremity with a very great number of minute recurved hooks, and furnished with powerful muscles, enabling the larva to retain strong hold of its place of rest. The number of these prolegs varies, however, from ten to four, the last pair, with a few exceptions (Cerura, Stauropus, &c.), being placed on the anal segment of the body.* The sides of the body are furnished with nine pairs of spiracles; the head is armed with a pair of powerful mandibles, a moderate-sized upper lip, often

* One of the nocturnal genera has been termed Apoda *Haw.*, Limacodes *Latr.*, from being destitute of feet in the larva state.

emarginate on the middle of the front edge, and the maxillæ and labium are small, fleshy, and soldered together, the spinneret arising from the centre of the labium. The body of these larvæ is often naked, but more commonly more or less clothed with hairs, spines, or warts. Previous to assuming the pupa state, these caterpillars undergo a series of moultings, generally four in number. When full grown, they prepare for pupation, either by constructing cocoons entirely formed of silk, or mixed up with various additional materials, or by securely affixing themselves in situations of safety; some species simply suspending themselves by the tail, whilst other tribes ingeniously hold themselves up by fixing a cord across the middle of the body. The details of these proceedings, as well as the various constructions of cocoons of different kinds, have been elaborately detailed by Réaumur in his *Mémoires*. Bonnet, also, has published many very interesting detached observations upon these subjects. The pupæ of these insects are different in their appearance, some being of a conical form, and others more or less angulated; the former invariably producing moths, and the latter butterflies, being also naked; the angular projections of their bodies not rendering their situation inside a cocoon so commodious as the conical chrysalides.

The chrysalis state of Lepidopterous insects is of that kind termed obtected; the insect being incapable of eating or walking, with the limbs laid close upon the sides and breast, folded up under a hard skin, on which account they are much less distinctly perceptible than in other pupæ, bearing, indeed, a great resemblance to an Egyptian mummy; whence, Mr. Inwood, in a curious dissertation upon the Egyptian arts, has been led to consider that this and other designs had their origin in natural objects.

The chrysalis, upon quitting the exuviæ of the caterpillar, is soft and tender: by degrees, however, its external envelope becomes hard and friable; the surface of the body is at first moistened with a viscid fluid, which exudes from beneath the wings and the other parts which are enclosed between these organs, and which becomes thickened, and hardens rapidly, and in so doing glues together the contiguous parts, which are consequently now enclosed in an additional envelope *; this taking place within twenty-four hours after the change, previous to which time it is easy to separate the various external organs of the

* See my memoir on Eucheira socialis, as to the disposition of the limbs in the chrysalis. (Trans. Ent. Soc. vol. i.)

future butterfly. From the anterior extremity of the body are to be observed several small and narrow longitudinal compartments, arranged like mummy bands, and extending over the breast: these are the coverings of the legs, spiral tongue, and antennæ; the part from whence they seem to arise is the head, which is covered with a piece termed the cephalotheca. On the outside of these narrow bands are to be observed two broader scales, which, covering the wings, are termed pterotheca, arising from the opposite side to the breast, and which is the covering of the thorax, or cytotheca. This is followed by the abdomen case, gastrotheca. The covering of the spiral tongue is, in some species of Sphingidæ, detached, and forms a snout, reaching to the base of the abdomen.

When ready to assume the perfect state, the chrysalis skin bursts down the back and sides of the wing-covers, the anterior part separating into several parts, and allowing the inclosed butterfly to make its escape; which it does with its wings moist and in an unexpanded state. They soon, however, attain their full size; the insect discharges a few drops of a thick fluid, and, in the case of the cocoon-making species, the insect pushes its way through the substance of the cocoon, sometimes splitting or dissolving the silk in a manner not satisfactorily ascertained. Some pupæ have the segments furnished with rows of recurved spines, by which they are able to push themselves forward in the earth, or in the burrows the caterpillars had previously formed in wood, &c.

The food of this order of insects consists almost exclusively of vegetable matter, no part of the different kinds of plants being free from their attacks, although the leaves are the support of by far the greatest portion. I have had occasion to remark, in Loudon's *Arboretum Britannicum*, that plants of the same natural family are especially liable to the attacks of allied species of Lepidoptera, the affinities of the one confirming those of the other; and M. Boisduval asserts that an imported plant will be attacked by insects having a strong natural relation with those which fed upon it in its native clime (*Hist. Nat. Lep.* p. 52.). Some species of caterpillars are indeed polyphagous, but the majority confine themselves strictly to a single species of plant, and their allies are attached to the same group of plants. Species of butterflies, allied to P. Machaon, feed upon Umbelliferæ: those species of Papilio of North America, which are distinguished by their

yellow spots, live upon laurels, especially the sassafras; those of the group typified by P. Thoas or P. Agavus feed upon the orange tree. The species of Thais are appropriated to the Aristolochiæ, and the Parnassii (Doritis) to the Saxifrages. Pieris attacks the Cruciferæ; Colias, the herbaceous Leguminosæ; Danais, the Asclepiadeæ; Heliconides, the Passifloræ; Argynnis, the violet; and Hipparchia, the Gramineæ.

The geographical distribution of this order has been but little studied. Dependent as its species are almost exclusively upon the vegetable world, the same rules which regulate the latter will of course to a great degree apply to the former; and whilst particular tribes affect peculiar situations in a given country (as, for instance, Doritis mountainous districts), where peculiar tribes of plants are found, other tribes of great extent frequent other countries to which the tribes of plants to which they are attached are especially confined; thus, the Heliconides do not occur out of South America, the country of the Passifloraceæ: Castina and Erycina are also (almost exclusively) inhabitants of the same country. The gigantic Ornithopteri inhabit the islands of the Indian Archipelago, whilst the nearly equal-sized Morphos are natives of Brazil. Africa, owing to its arid soil and far-spread sand deserts, is but poor in the diurnal species, whilst South America, owing to exuberance in vegetable life, abounds with them, so that it may be considered that at least one third of the diurnal Lepidoptera are natives of that portion of the New World. Owing, probably, to this dependence upon the distribution of vegetables, certain species as well as genera are on the other hand Cosmopolites: thus, whilst Cynthia cardui occurs throughout Europe, Senegal, Egypt, Barbary, Cape of Good Hope, the Islands of Mauritius, and Madagascar, China, Bengal, Java, New Holland, Brazil, and North America, Vanessa Antiopa and Atalanta, Lycæna Phlæas, &c., are also very widely extended through the northern hemisphere, and some genera, such as the beautiful Deiopeiæ, are natives of almost every region. It is, however, by the publication of local Faunas, that we shall be best enabled to obtain a correct view of this subject, and therefore too much praise cannot be given to the compilation of such articles as Keferstein's observations on the "Apparition des Lépidoptères" (*Rév. Entomol.* No. 10.), Hess, *On the Lepidoptera of the Alps*, Beske's *Catalogue of Hamburg Lepidoptera*, Bory St. Vincent's *Lepidoptera of the Canary Isles*, Fridvalsky's *Lepidoptera of Hungary*,

Lepechin's *List of the Orenburg District*, Sodoffsky on those of Livonia, Brown's *List of Swiss Butterflies* in *Mag. Nat. Hist.* vol. viii., &c.

The relations of these insects with the other orders are various. Latreille considers them on the one side to be related to the Hymenoptera, the elongated tongue of Bombus and Apis leading towards the typical structure of the Lepidoptera, and on the other side the want of conformity which exists between the mouths of the larva and imago, indicating the relation which exists between the Lepidoptera and Diptera. Mr. MacLeay, however, considers them to be intermediate between the Homoptera and Diptera in the haustellated circle; the Homopterous genus Flata, and especially Flata limbata *Fab.*, being supposed to bear a distant affinity to certain extreme Lepidoptera as apparent from having been connected by Linnæus and Fabricius with such trivial names as Phalænoides, and from the admission of Latreille, that the Fabrician Flatæ "ressemblent à de petits phalènes ou mieux encore à des Pyrales." The immediate transition between Homoptera and Lepidoptera is supposed to be exemplified in the Homopterous genus Aleyrodes, or the Tinea proletella of Réaumur and Linnæus.

The Dipterous genus Psychoda *Latr.* (*Tinearia* Schell), and the Lepidopterous genus Pterophorus *Latr.* (*Phalènes tipules* De G.), are assumed to be the connecting links between the Diptera and Lepidoptera. The Lepidoptera are also at the same time regarded by MacLeay as forming a passage between the Trichoptera (amongst the Mandibulata) and the Haustellata. In the eruciform appearance of their larvæ they are to a certain extent related to the Tenthredinidæ, the larvæ of which greatly resemble the caterpillars of this order; but the closest affinity is that which exists between them and the Linnæan Phryganeæ. Thus, whilst Réaumur insists upon this affinity, as proved by the general appearance of the insects, De Geer, upon the correspondence between the form of their wings and the internal organisation of the larvæ, and Kirby upon the resemblance of the trophi of the Trichoptera and these insects, other and equally striking grounds of relation are to be found between the two orders; the case-bearing habit of the caterpillars existing in certain groups (Oiketicus, Psyche, and some Tineæ), the nature of the clothing of the wings of Phryganea repeated in certain Tineidæ, the spinose tibiæ of both groups, the elongated antennæ of the Adelæ and Leptoceri, all tend to prove this relationship so strong as to render it almost impossible

in certain cases to decide to which of the two orders an insect may belong. Such is especially the case with Psyche, which Mr. Newman even places amongst the Neuroptera, and the Acentropus Garnonsii *Curt.* (Acentria nivosa *Steph.*), placed by Stephens in the order Neuroptera, and by Curtis in the Trichoptera, on the ground that the maxillary palpi are strongly developed, and the labial palpi absent. (*Brit. Entomol.* p. 497.) This character he has, however, set aside in treating of the genus Eriocephala, a curious group of minute (supposed*) moths (Tinea calthella *Linn. &c.*), in which the labial palpi are minute, and the maxillary greatly elongated as in the Trichoptera, and in which the anterior tibiæ are furnished with an inner spine, a character which is asserted to be possessed by no true Trichopterous insect. Acentropus, it is true, is destitute of any such spine, but then its four hind legs are also destitute of spurs, which would remove it both from the Trichoptera and Lepidoptera, and such, indeed, was the cause which induced Mr. Stephens to place it amongst the Neuroptera; but, notwithstanding the want of this character†, Acentropus appears to me to belong decidedly to the order Lepidoptera, possessing two characters peculiarly characteristic of the order which Mr. Curtis has overlooked, namely, a pair of large mesothoracic paraptera, or tegulæ, and the hook and bristle above described; neither do I think Mr. Curtis justified in regarding the palpi of Acentropus as maxillary appendages, deeming them rather to be labial palpi.

The classification of this order, as before observed, has hitherto been greatly neglected with respect to the true relations of the various groups founded upon a careful investigation of their, often recondite, characters. Linnæus, in the earlier editions of the *Systema Naturæ*, adopted only two genera, Papilio and Phalæna. In the later editions,

* The existence of a species possessing a character not according with that of the rest of the order is not sufficient ground for considering such character not to be characteristic of the order; and hence the possession by Eriocephala of maxillary palpi enormously developed, would neither be sufficient in itself to remove it from the order, nor to authorise us in not considering the comparatively superior length of the labial palpi over that of the maxillary, as characteristic of the order; but Eriocephala has other characters at least as strongly divaricating from the typical structure of the Lepidoptera, namely, the neuration of the wings, the formation of the labial palpi, and the general habit of the insect.

† If the existence of an internal spur on the anterior tibiæ were the real characteristic to distinguish a Lepidopterous from a Trichopterous insect, a great number of species, belonging unquestionably to the former order, would require to be removed from it, especially amongst the diurnal species.

however, he added a third, Sphinx, dividing Papilio into five, and Phalæna into eight sections. Latreille adopted these three groups, to which he gave the sectional names of DIURNA, CREPUSCULARIA, and NOCTURNA. Mr. Stephens, rejecting the last of these three sections, has proposed another arrangement, dividing the order into six primary groups, namely: 1. DIURNA: 2. CREPUSCULARIA: 3. POMERIDIANA: corresponding with the Linnæan Phalæna Bombyx, and comprising four families, Hepialidæ, Bombycidæ, Notodontidæ and Arctiidæ: 4. NOCTURNA, corresponding with the Linnæan Phalæna Noctua, and comprising two families, Lithosiidæ and Noctuidæ: 5. SEMIDIURNA, corresponding with the Linnæan Phalæna Geometra and Pyralis, and comprising three families, Geometridæ, Platyptericidæ and Pyralidæ: and 6. VESPERTINA, corresponding with the Linnæan Phalæna Tortrix, Tinea and Alucita, and comprising four families, Tortricidæ, Yponomeutidæ, Tineidæ, and Alucitidæ. It cannot, however, be denied that the first of these primary groups is of higher value, and presents more exclusive characters than any of the rest. The preceding, together with other classifications proposed by Dumeril, Lamarck, Dalman, &c., are for the most part founded upon considerations derived from the perfect state of the insect; or if the preparatory states are taken into account, it is only in a secondary manner. It will be easily conceived, however, from the general principles enforced in the preceding pages of this work, that arrangements founded upon the transformations of these insects, or upon a natural combination of their relations inter se, are, at least in my opinion, entitled to far higher weight than the preceding; and although we are still lamentably deficient in the knowledge of the transformations of exotic species, and indeed still possess, at best, but a most superficial knowledge of exotic Lepidoptera, more especially of the nocturnal species, yet every attempt made to distribute the order upon principles resting upon these considerations has proved far more successful than any others. Indeed, whilst it is only recently that zoologists in general have arrived at the truth that an animal cannot find a natural and definitive place amongst its relations, until, not only its own entire adult organisation is fully investigated, but, also, all the peculiarities which it exhibits in its progress to maturity are known, Lepidopterists have long adopted the latter principle, owing, it must be confessed, to the great difficulty which attends the investigation of this order, and, it must be confessed, to the dislike which the possessors of rare and beautiful specimens have

to injure their collections by sacrificing them to the dissecting knife. There are, it is true, still some Lepidopterists who insist upon the inutility of inquiries into the preparatory states, and the sufficiency of characters from the imago, especially M. Duponchel (*Ann. Soc. Ent. de France*, 1837), but it appears to me that nowhere are they of more value than in the present order, for as Boisduval well observes, "Les organes, qui, dans les autres ordres, jouent le premier rôle dans l'établissement des coupes, sont dans celui-ci d'un faible sécours." (*Hist. Nat. Ins. Lépidopt.* vol. i. *Introd.* p. ii.)

Messrs. Denis and Schiffermüller in an anonymous work published at Vienna in 1776, being a systematic catalogue of the Lepidoptera found in the environs of that city, have employed the larvæ exclusively to characterise the divisions of the order to which, however, they gave no names, but simply indicated them by letters, almost every one of which constitute modern genera. Their arrangement is as follows.

Sphinx divided into seven families. A. *Larvæ acrocephalæ:* Sph. ocellata (Smerinthus). B. *Amplocephalæ:* Sph. Convolvuli (Sphinx). C. *Maculatæ:* Sph. Euphorbiæ (Deilephila). D. *Opthalmicæ:* Sph. celerio (Stirps Eumorphæ *Hubner*). E. *Elongatæ:* Sph. Stellatarum (Macroglossa). E. *Subpilosæ:* Sph. Apiformis (Sesia). G. *Phalæniformes:* Sph. filipendulæ (Zygæna).

Bombyx divided into 20 families. 1. Larvæ with 16 feet. A. *Larvæ sphingiformes:* Bom. versicolora (Endromis). B. *Verticillatæ:* Bom. Pyri (Saturnia). C. *Tuberosæ:* Bom. Rubea (Penthophora *Germar*). D. *Nodosæ:* Bom. Salicis (Leucoma *Steph.*). E. *Ursinæ:* Bom. Caja (Arctia *Schr.*). F. *Celeripedes:* Bom. lubricipeda (Spilosoma *Steph.*). G. *Fasciculatæ:* Bom. pudibunda (Dasycheira *Steph.*). H. *Cristatæ:* Bom. curtula (Clostera *Hgg.*). I. *Collariæ:* Bom. Quercifolia (Gastropacha *Ochs.*). K. *Villosæ:* Bom. Quercus (Lasiocampa *Schr.*). L. *Pilosæ:* Bom. lanestris (Eriogaster *Germ.*). M. *Subpilosæ:* Bom. Bucephala (Pygæra). N. *Lignivoræ:* Bom. Cossus (Cossus). O. *Radicivoræ:* Bom. Humuli (Hepialus). P. *Noctuiformes:* Bom. Cassinea (Petasia *Steph.*). Q. *Geometriformes:* Bom. Palpina (Pterostoma *Germ.*). R. *Gibbosæ:* Bom. Dromedarius (Notodonta). 2. Larvæ with 14 feet. S. *Furcatæ:* Bom. Vinula (Cerura). T. *Cuspidatæ:* Bom. Sicula (Platypteryx). 3. Larvæ without conspicuous feet. U. *Limaciformes:* Bom. Testudo (Limacodes).

Noctuæ. 1. Larvæ with 14 feet. A. *Larvæ tentaculatæ:* Noc. Ulmi (Uropus). 2. Larvæ with 16 feet. B. *Bombyciformes:* Noc. tridens (Acronycta). C. *Tineiformes:* Noc. Quadra (Lithosia). D. *Rhomboidæ:* Noc. Paliolalis (Hercyna). E. *Pubescentes:* Noc. Algæ (Bryophila). F. *Corticinæ:* Noc. bimaculata (Miselia). H. *Tenuistriatæ:* Noc. flavicincta (Polia). I. *Variegatæ:* Noc. Absinthii (Cucullia). K. *Albosparsæ:* Noc. exoleta (Xylina). L. *Albopunctatæ:* Noc. instabilis (Orthosia). M. *Albilateres:* Noc. Pistacina (Orthosia B. *Steph.*). N. *Terricolæ:* Noc. suffusa (Agrotis). O. *Largo-striatæ:* (several groups). P. *Obliquo-striatæ:* Noc. meticulosa (Phlogophora). Q. *Arctostriatæ:* Noc. Comma (Leucania). R. *Scutellatæ:* Noc. vaccinii (Cerastis). S. *Ochrocephalæ:* Noc.

citrago (Xanthia). T. *Larvicidæ:* (several groups). V. *Furtivæ:* Noc. Latruncula (Apamæa). W. *Curvilineatæ:* Noc. Ononis (Heliothis). X. *Ciliatæ:* Noc. Fraxini (Catocala). Y. *Pseudo-geometricæ:* Noc. triplasia (Abrostola). 3. Larvæ with 12 feet. Z. *Larvæ semigeometræ:* Noc. Festucæ (Plusia). AA. *Serpentinæ:* Noc. lunaris (Ophiusa).

Geometræ. 1. Larvæ with 12 feet. A. *Larvæ seminoctuales:* Geo. margaritaria (Ellopia). B. *Stoloniformes:* Geo. Cythisaria (Geometra). C. *Corticinæ:* Geo. hirtaria (Amphidasis). D. *Pedunculares:* Geo. roboraria (Boarmia). E. *Surculiformes:* (several groups). F. *Ramiformes:* Geo. Alniaria (Ennomos). G. *Striatæ:* Geo. defoliaria (Hybernia). H. *Strigillatæ:* Geo. pendularia (Cabera). I. *Rigidæ:* Geo. Pullata (Gnophos). K. *Noctuiformes:* Geo. rhamnata (Acidalia). L. *Rugosæ:* Geo. bipunctaria (Larentia). M. *Squamosæ:* Geo. fulvata (Cidaria). N. *Signatæ:* Geo. Adustata (Zerene). O. *Punctatæ:* Geo. dealbata (Idæa). P. *Filiformes:* Geo. vibicaria (Pellonia).

Pyralis, Tortrix, Tinea, and Alucita, are arranged according to the forms and colours of the imago, their caterpillars being so little known.

Papilio. A. *Larvæ tortriciformes:* Pap. Malvæ (Hesperia). B. *Bombyciformes:* Pap. Apollo (Doritis *Fab.*). C. *Variegatæ:* Pap. Machaon (Papilio). D. *mediostriatæ:* Pap. Cratægi (Pieris). E. *Pallidiventres:* Pap. Hyale (Colias). F. *Subfurcatæ:* Pap. Ægeria (Hipparchia). G. *Cornutæ:* Pap. Ilia (Apatura). H. *Subspinosæ:* Pap. Camilla (Limenitis). I. *Acutospinosæ:* Pap. Atalanta (Vanessa). K. *Collospinosæ:* Pap. Paphia (Argynnis). L. *Pseudospinosæ:* Pap. Phœbe (Melitæa). *Larvæ onisciformes:* M. *Oblongo-scutatæ:* Pap. virgaureæ (Lycæna). N. *Gibboso-scutatæ:* Pap. Meleager (Polyommatus). O. *depresso-scutatæ:* Pap. Pruni (Thecla). P. *Ignotæ: Ascalaphus!*

Dr. Horsfield, in his work upon the Lepidoptera of Java, has pursued a somewhat similar course, having paid particular attention to the transformations of the Lepidoptera of that island during a long residence, whence the leading divisions of the *Weiner Verzeichniss* were found to accord almost precisely with those which Dr. Horsfield had proposed to himself previously to his becoming acquainted with that work. Dr. Horsfield endeavoured to follow up the quinarian and circular principles of MacLeay, and accordingly divided the Lepidoptera into five primary sections, namely, Papilionidæ, Sphingidæ, Bombycidæ, Noctuidæ, and Phalænidæ, without, however, venturing to characterise these primary sections, inappropriately named, as it appears to me, as though they were families. The butterflies (Papilionidæ), which Dr. Horsfield has most especially investigated, constitute five stirpes, which, in accordance with the principles of MacLeay, he arranges and names from the analogies which they exhibit to the orders of Ametabola, namely, 1. *Vermiform Stirps*, corresponding with the Lycænidæ of Stephens; 2. *Chilognathiform Stirps* (Colias, Papilio, Doritis, &c.); 3. *Chilopodiform Stirps* (Eu-

plœa, Vanessa, Argynnis, &c.); 4. *Thysanuriform Stirps* (Apatura, Morpho, Hipparchia, &c.); and, 5. *Anopluriform Stirps* (Erycina, Hesperia, &c.). The stirps are related *inter se* by means of aberrant genera, whereby not only the progression of affinities is maintained, but the circle of the diurnal Lepidoptera, completed by means of Barbicornis (my *fig.* 101. 5.), which is supposed to connect the Papilionides and the Hesperides.

The Sphingidæ are also supposed to exhibit five types of form in the larvæ. These are exemplified by Zygæna, Macroglossa, Smerinthus, Acherontia, and Sphinx; Ægeria and its allies being supposed to possess a different metamorphosis, are omitted, being considered, at least in part, to enter into the next tribe; Zygæna, and its allies, ought also to have been rejected from the Sphingidæ, with which they exhibit but little relationship.

The Bombycidæ, also, although admitted to be less generally known in their early states, exhibit five prominent forms: — 1. Fasciculatæ, typified by Laria and Arctia; 2. Verticillatæ, typical genera Limacodes and Saturnia; 3. Pilosæ, typical genus Lasiocampa; 4. Lignivoræ, typical genera Pygæra, Cossus, and Hepialus; 5. Cuspidatæ, typical genera Cerura, Notodonta.

The five stirpes of the Noctuidæ are also formed, although only provisionally, from the larvæ: — 1. Nudæ, typical genera Agrotis, Mamestra, Polia, &c. (which are considered as typical of the tribe); 2. Fusiformes, typical genus Lithosia, with which, possibly, many of the Tineæ may also be associated; 3. Fasciatæ; 4. Ciliatæ, typical genera Catocala and Abrostola; 5. Semigeometræ, type Plusia.

The remaining tribe, Phalænidæ, also exhibits, among the larvæ of the insects which compose it, five types of form, the precise limits of which require more detailed investigation. They are: — 1. Seminoctuales, Phal. Margaritaria, &c.; 2. Geometræ, or true loopers; 3. Pyralidæ (containing in the *Weiner Verzeichniss* two families, answering to Herminia and Botys; 4. Tortrices; 5. Tineæ.

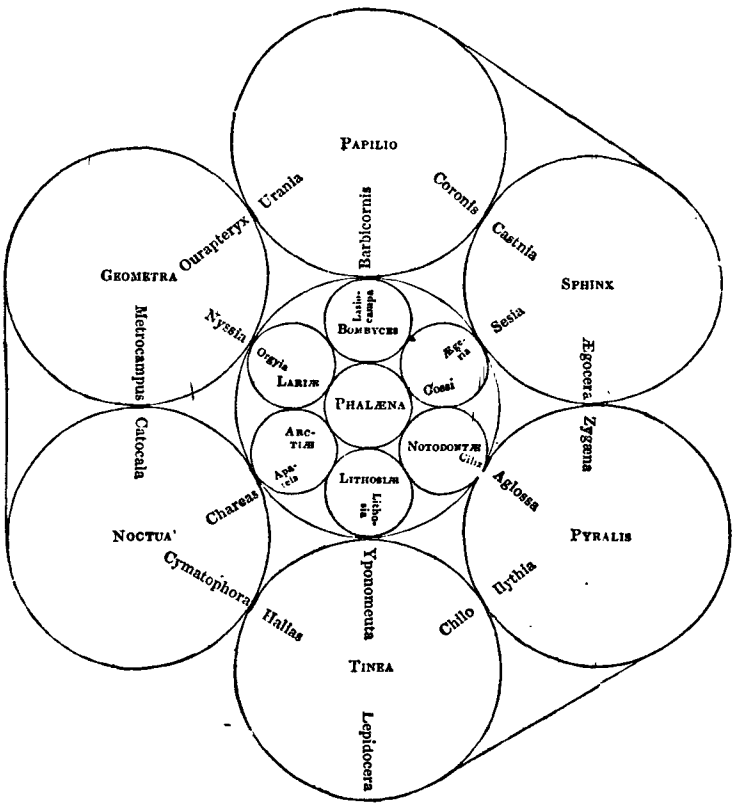
The arrangement of the last four of these tribes given above is admitted to be but a provisional sketch, of which the outlines require to be filled up in future numbers of the work. It is consequently to be regretted that only two parts, comprising but a portion of the diurnal Lepidoptera, have hitherto been published. Dr. Horsfield endeavours to complete the Lepidopterous circle by means of Hesperia, which in its structural characters and tortriciform larvæ (which

roll up leaves, &c.), exhibits a decided departure from the typical Diurna, and a tendency towards some of the nocturnal Lepidoptera, as the Tortrices. Affinities also of a more general nature exist between the Papilionidæ and Phalænidæ. The situation of the genus Pterophorus, which, according to Réaumur and the *Weiner Verzeichniss*, is to be considered as intermediate between the diurnal and nocturnal Lepidoptera, he does not attempt to determine. With the exception, therefore, of the diurnal species, but little progress is here made in the classification of the order. A plan is indeed indicated for its natural arrangement; but it appears to me that the nocturnal groups will be found, when more satisfactorily investigated, by no means to correspond with these views.

A more ingenious arrangement of the order has been attempted by Mr. Newman in his Essay, "Sphinx Vespiformis." Proceeding upon the principle that seven is the typical number of groups in every higher group, and that one of these seven groups contains types of all the other six, which are arranged around it as a centre, touching its circumference by means of aberrant genera — each of the six outer circles also coming into contact with the two adjacent circles by similar aberrant genera — an arrangement is proposed which certainly involves a greater number of affinities than are to be traced in any previous classification. His plan of distribution may be learned from the diagram shown in next page.

The same objection appears to me to exist here as in the classifications above noticed, namely, that the minor divisions of the nocturnal Lepidoptera are elevated to a rank equivalent to that of the whole of the Diurna.

A more recent author, M. Boisduval, in his *Hist. Nat. des Insectes Lépidoptères*, has obviated this difficulty, by dividing the Lepidoptera into only two primary groups, for which, in order to avoid the incorrect notions produced by the terms diurna and nocturna (many of the species of the nocturnal Lepidoptera being, in fact, day-fliers), he has proposed the names of Rhopalocera (club-horned) for the butterflies, and Heterocera (varied-horned) for the moths, including the Sphinges, which he does not consider a distinct primary group; and as this appears to me to be an advantageous step, I shall here adopt it.



The first section of the Lepidoptera*, that of the Rhopalocera *Dumer., Boisd.* (Diurna *Latr.*), corresponds with the genus Papilio *Linn.*,

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* Bibliogr. Refer. to the Diurnal Lepidoptera.

Petiver. Papilionum Britanniæ Icones, &c. fol. Lond. 1717.

Jones. A New Arrangement of Papilios from the Nerves of Wings, in *Trans. Linn. Soc.* vol. ii.

Schilling, in Isis, 1834, Arrangement of ditto from Nerves.

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Lewin. The Papilios of Great Britain. London, 1795, 4to.

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Bober. Nouv. Papillons en Sibérie, Mém. Nat. Mosc. 1806.

and derives its former name from its chief character, that of having the antennæ, which are very thin and elongated, terminated by a knob (*fig.* 95. 7.); in a very few species, however, Barbicornis (*fig.* 101. 5.),

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Bonelli. Desc. 6 n. sp. collected in Sardinia (Mém. Acad. Turin, tom. xxx.).
Herold. Entwickelungs. der Schmetterl. 4to. Cassel and Marburg, 1815.
———? Coloured Specimens to illustrate the natural History of Butterflies, from the Collection of Mr. Lee, Hammersmith. London, 1806, folio.
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Lacordaire. Review of ditto in Guérin's Mag. Zool. No. 2. (Bulletin Zool.)
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Dale. Observ. on the Influence of Locality, &c. on Butterflies, in Entomol. Mag. July, 1833. — Ditto, in Mag. Nat. Hist., various notices.
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Morisse. Memoir on Erycina in Ann. Soc. Ent. de France, 1837.
Zincken, gen. Sommer. Beytr. zur Ins. Java (Papil.) in Nova Act. Natur. Curios. Bonn, t. xv.
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———? Ueber einen Schmetterlingszwitter Papilio Cinxia, in Froriep's Notizien Maij, 1825. No. 210.
Anonymous. British Butterflies; their Distinctions, &c. Birmingham, 1828. 12mo.
Duncan. Natural History of British Butterflies. Edinburgh, 1835. — Ditto, Foreign Butterflies. Edinburgh, 1837 (in the Naturalist's Library).
And the general works on Lepidoptera above referred to.

Fig. 95.

Petavia (*fig.* 101. 3.), and some species of Morpho*, the antennæ are filiform, and even slightly pectinated, without any knob; in others they are hooked at the tip, the ocelli are wanting, the spiral tongue (*fig.* 95. 3.) always elongated, the wings not confined together by means of a hook and bridle†, and carried erect when in repose (*fig.* 95. 1.). In some few, however (Hesperia), the fore wings alone are elevated when at rest. The hind tibiæ are ordinarily furnished only with a pair of spurs at the apex, although in Hesperia there is an additional pair near the centre, as in the moths. The flight is constantly during the day. The larvæ (*fig.* 95. 9.) are of varied shape; they have always six pectoral, eight abdominal, and two anal feet; but the pupæ (*fig.* 95. 10.) are generally angulated (*fig.* 98. 3.), and almost always naked; a very few species, however, roll up leaves, which they web together, and therein assume the pupa state, which is termed Chrysalis or Aurelia, from the golden colours exhibited by many species. This section comprises the well-known tribes of butterflies, which, both from their elegant forms and beautiful colours (which are as varied and brilliant on the under as the upper side of the wings), may almost be mistaken, as Moore sings, for

"winged flowers or flying gems."

Spenser well describes some of the chief characteristics of this favourite tribe of insects in the following lines:—

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* Latreille (*Règne An.* tom. v. p. 386.) describes a genus Zephyrius *Dalm.* as having the tips of the antennæ moniliform; founding his observation upon Dalman's *Anal. Ent.* p. 102. The genus is, however, synonymous with Polyommatus.

† From the observations of Mr. Haworth (*Lep. Brit.* p. 19.) upon the strong flight of the males of the purple emperor (Apatura Iris), it would appear that the males of that species possess this socket and spring, as he terms this apparatus, and of which the females, which fly but little, are destitute.

" The velvet nap which on his wings doth lie,
The silken down with which his back is dight,
His broad outstretched horns, his airy thighs,
His glorious colours and his glistening eye."

The number of species of butterflies is very considerable. Latreille and Godart described not less than 1804 in the *Encyclopédie Méthod.*, of which 237 are natives of Europe, and considerable additions have been made to the number. They vary greatly in size, the gigantic Indian Ornithopteri being at least nine or ten inches in expanse, whilst some of our little British blues are not an inch across the wings. In their colours they are also equally variable, for, being born to flutter in the brightest sunshine, they are (like all sun-loving animals) much more gaily coloured than their nocturnal brethren. Their flight is also as varied as that of the feathered tribes, and the skilful collector knows at a distance the flight of the different genera, and even occasionally that of particular species. The power of flight depends considerably on the robustness of the thorax and the strength of the wing veins; thus some of the Nymphalidæ are far more powerful fliers, even than the great Swallow-tailed butterflies: such, for instance, is especially the case with Charaxes Jason (Jasius auct.); others, as the Pontiæ, fly with an undulating flight, whilst Apatura sails over the topmost branches of the oak and the

" swift Camilla
Flies o'er the unbending corn, and skims along the main,"

with such graceful elegance, that an old Aurelian is described by Mr. Haworth as going to the woods long after he was unable to follow it, and taking his seat on a stile " for the sole purpose of feasting his eyes with her graceful evolutions." The knowledge of the diversity in the flight of the different tribes is, as Lacordaire well observes, " le fruit d'une expérience toute personnelle, et ne peut guère se transmettre par de simples descriptions." (*Ann. Soc. Ent. de France*, 1833, p. 382.) This author has, however, published a long and very interesting account of the butterflies of French Guiana in the memoir here referred to, and particularly described the mode of flight, habitats, &c., of the various groups. The prevalence of particular colours in certain groups has been above alluded to: thus amongst the Pierides it is either white or orange tipped with black; in the Hipparchiæ, dull brown; in Polyommatus, blue; in Lycæna, fulgid copper; the Nymphalidæ have their wings varied with

beautiful eyes or spots. The Fritillaries are fulvous, varied on the under side with pearly patches. Various species of butterflies are remarkable for their periodical or irregular appearance: of these the species of Colias, or clouded yellows, as they are termed by collectors, Cynthia Cardui and Vanessa Antiopa, are pre-eminent; thus the last-named insect, according to Mr. Haworth (*Lep. Brit.* p. 28.), will not be seen for eight, ten, or more years, and then appear as plentiful as before; indeed, about seventy years ago, it suddenly occurred in such profusion as to obtain the name of the Grand Surprise from the Aurelians of that day. Mr. Haworth conjectures this may be owing to the eggs having, like the seeds of plants, lain dormant, not hatching until some extraordinary but undiscovered coincidences awake them into active life; others attribute it to the failure of their natural enemies, as the Ichneumons and soft-billed birds, and others to an increased temperature. But these are mere conjectures, and seem to want confirmation from the circumstance noticed by Stephens (*Illustr. Haust.* vol. i. p. 10.); that Cynthia Cardui, although periodical in some places ("occurring every third or fourth year most copiously, and breeding even in the metropolis itself;" *Stephens*, vol. i. p. 48.), appears constantly in others; and see Bree, in *Mag. Nat. Hist.* No. 39.

The majority of these insects are but short-lived, but certain individuals of some species survive the winter, passing that period of the year in a state of lethargy. It has been generally supposed that these (which chiefly belong to the g nus Vanessa) were females which had been produced late in the preceding autumn, and which, although impregnated at that time, had delayed the act of oviposition until the renewal of the season brings forth a fresh supply of food for their offspring. M. Boisduval, however, opposes this, stating that these individuals had undergone a state of lethargy from a much earlier period (having observed Vanessa Polychloros and Urtica in this state in August), and that their impregnation had not taken place until the following spring.* Mr. Stephens states that both sexes of Gonepteryx Rhamni hybernate. Other species appear to be double-brooded in the course of the year (Papilio Machaon, Gonepteryx Rhamni, &c.); some of these, however, in certain seasons, seem only to be single-brooded (as Polyommatus Argiolus).

* See hereon Brown, in *Mag. Nat. Hist.* No. 39., and Bree *contrà*, in ditto, No. 42.

The sexes, although generally resembling each other, offer occasionally various distinctions, especially in colour, the males in such cases being almost invariably more gaily coloured: this is especially the case in the Polyommati, Apaturæ, and Lycænæ. In these the upper surface alone offers this distinction; the males of Mancipium Cardamines have a bright orange spot at the tips of the fore wings. In Thecla Quercus, however (as proved by the dissections of Dr. Horsfield), the individuals which have a bright purple patch on the upper surface of the wings, and which have been by all other writers described as the males, are proved to be the females. The males of other species of the genus, as I have ascertained, are ornamented with purple reflections. Some Argynnes have black longitudinal ribs on the fore wings of the males; and Mr. Haworth describes the female of Vanessa Atalanta as differing from the male in having a minute white dot in the central red fascia of the fore wings. Mr. Babington has noticed a difference in the colouring of the pupæ of the two sexes of Pap. Machaon (*Mag. Nat. Hist.* No. 6.). Very few species of butterflies are gregarious in the larva state; those, however, of the Glanville fritillary live in societies not consisting of a hundred individuals in a kind of common tent which they construct upon the plantain. Several species of Vanessa are also social in this state, frequenting the nettle (V. Urticæ and V. Io); as are also those of Papilio Archelaus, which live upon the orange trees in French Guiana (Lacordaire in *Ann. Soc. Ent. de France*, 1833, p. 385.). But a more perfect state of society is exhibited by a Mexican butterfly (Eucheira socialis *Westw.*), the caterpillars of which construct a very strong parchment-like bag, in which they not only reside, but undergo their change to the pupa state. (*Trans. Ent. Soc.* vol. i. p. 38.) A similar occasional habit of congregating is exhibited by these insects in the perfect state. Such cannot, indeed, be said of the great numbers of white butterflies which may occasionally be seen resting around the edges of ponds and other damp places, of which I have occasionally been witness; but an immense swarm of Cynthia Cardui was observed in the Canton de Vaud in 1828, forming a column from ten to fifteen feet broad, traversing the country from north to south. Bonelli also observed a similar flight of the same species in the preceding year at the end of March. (*Mém. Soc. Phys. de Genève.*) De Loche also described a similar flight of C. Cardui, at the close of the last century

(*Turin. Trans.* vol. vi.; and see Blyth, in *Field Nat.* p. 470.); and Captain Lyon, in his *Travels in Mexico* (vol. i. p. 70.), mentions having observed butterflies assembled in vast numbers, settled in patches several square yards in extent. M. Donzel has published a curious memoir upon the flight of butterflies whilst coupling (*Ann. Soc. Ent. de France*, 1837, p. 77.), showing that whilst the males of Pontia Brassicæ, &c., Colias and Polyommatus, support the females, it is the latter which support their partners in the genera Thais, Thecla, Argynnis, Melitæa, Hipparchia, and Pieris (P. Cratægi, formed by Donzel into the genus Leuconea).

In respect to their transformations, these insects exhibit three principal variations, the chrysalides being either suspended, girt, or enveloped in a cocoon. In the first of these, the caterpillar, when full grown, spins a small web upon the under side of a leaf or twig, and, holding this by its hind pair of anal feet, it drops its head down, when the skin bursting, the head of the chrysalis appears. By degrees the caterpillar skin is pushed upwards, until it is reduced to a minute shrivelled mass, which, however, still serves as a support to the chrysalis, by the pliability of the terminal segments of the body. Still retaining this situation, it contrives to disengage the extremity of the body through the slit side, to extend it upward, and to fasten it to the little cone of silk by means of various minute hooks. After it has accomplished this delicate task, it gets rid of the old exuvia by giving the body a jerking kind of a twirl, by which the slough is detached, and then falls. In the girt chrysalides, the caterpillars not only attach themselves by the tails, but also, by throwing the head from side to side, spin a number of threads across the middle of the body. The skin of the caterpillar then bursts, and is sloughed off; the contractions of the body forcing it beneath the girth. The number of the species which enclose themselves in cocoons is but small. Some of these spin a slight silken case, whilst others make for themselves a more substantial covering, by fastening several leaves together with threads, after the manner of the Tortricidæ. In the two former variations the chrysalis is always angulated, but in the latter it is conical, like that of the moths.

It is to be observed that those chrysalides which are simply suspended almost always produce tetrapod butterflies; a curious fact, because, if any butterflies required more than the rest a perfect pair of fore legs, we should have thought it would have been those which

are suspended head downwards in the pupa state, and which have to ascend the slight exuviæ of the chrysalis case; whilst the hexapod butterflies, being girt so as to lie in a horizontal position, have only to creep out of their case. Some exceptions occur against this rule, as in the case of the gregarious Mexican butterfly, described by me under the name of Eucheira socialis (*Trans. Ent. Soc.* vol. i. pl. 6.), which, although simply suspended by the tail in the chrysalis state, is provided with perfect fore legs. The Libythiæ also, which have suspended pupæ, are also furnished, at least in the females, with six feet. The Peridromides, on the other hand, have the chrysalides girt, and yet they possess only four perfect feet.

The pupæ of many butterflies belonging to the families Heliconiidæ and Nymphalidæ are ornamented with golden spots, whence they were termed Aureliæ, or chrysalides. This appearance was seized upon by the alchemists in support of their doctrines; but Réaumur in France, and Lister and Ray in England, clearly proved that it originated in the shining white membrane seen through the very slender and transparent outer skin. It is requisite also, for the preservation of this appearance, that the inner membrane be moist, and hence the gilding disappears when the absorption of the fluids has been effected by the inclosed insect's approach to perfection. Ray has related various experiments upon this subject in his *Letters*. (Edited by Derham, pp. 82. 86. 88. 90.)

Some species of these insects have afforded materials to several entomotomists for the production of elaborate memoirs upon their anatomy. Swammerdam, especially (in his *History of Insects*), investigated that of the great cabbage butterfly, and the tortoiseshell butterfly of the nettle. Herold, also, in his *Entwickelungs. der Schmetterlinge*, has also studied the former species, especially tracing the variations which its internal organs undergo during the process of transformation.

Linnæus divided the genus Papilio into five principal groups.

A. *Equites.* — Having the fore wings longer from the posterior angle to the apex than to the base; subdivided into Troes (Trojans), having red spots on the breast, and Achivi (Greeks), having no such spots.

B. *Heliconii.* — Wings narrow, entire, often almost naked.

C. *Danai.* — Wings entire; subdivided into Candidi, with white wings, and Festivi, with variegated wings.

D. *Nymphales.* — Wings dentated; subdivided into Ocellati, or those with eye-like spots, and Phalerati, or those with simple spots.

E. *Plebeii.* — Of small size; larvæ often short and thick; subdivided into Rurales, or those with dark spots, and Urbicolæ, or those with pellucid spots. (*Syst. Nat.* tom. ii. p. 744. note.)

Latreille divides them, in the *Règne Animal*, from characters taken from other parts of the insect, as well as from its preparatory states, into two primary, and various secondary, sections, as follows: —

1. Those which have only one pair of spurs at the extremity of the tibiæ; the four wings are elevated in repose; and the antennæ are clavate or filiform.
   a. Those which have the third joint of the labial palpi either rudimental, or, if present, clothed with scales, and the claws of the tarsi are large; caterpillars nearly cylindrical.
      * The Hexapoda, which have all the feet fit for walking, and nearly alike in both sexes; the pupa is girt, as well as attached, by the tail; and the central cell of the hind wings is posteriorly closed. Genera Papilio, Zelima, and Parnassius, which have the anal edge of the hind wings hollowed, or folded; and Pieris (Pontia) and Colias, which have the same edge produced under the abdomen, forming a kind of gutter.
      ** The Tetrapoda have the fore legs evidently shortened, and unfitted for walking, either in both sexes or in the females alone; the chrysalis is simply suspended.
         † Those in which the fore legs, although smaller, differ but little in form from the others; the central cell of the hind wing is closed; and the labial palpi are small. Genera Danais, Euplœa, Idea, Heliconius, and Acræa.
         †† Those which have the two fore legs strongly folded up, and either visible, but very hairy, or very small and concealed; the hind wings have the central cell generally open; the labial palpi are larger. Genera Cethosia, Argynnis, Melitæa, Vanessa, Libythea, Biblis, Nymphalis, Morpho, Pavonia, Brassolis, Eumenia, Eurybia, Hipparchia (Satyrus *Latr.*).
   b. Those which have the third joint of the labial palpi naked; the claws of the tarsi are minute; the caterpillars are like wood-lice; and the chrysalides girt, as well as attached at the tail.
      * Those which have the antennæ clavate.
         † Those with the fore legs of the males, at least, much shorter than the others. Erycina.
         †† Those with the fore legs alike in both sexes. Myrina, Polyommatus (Lycæna, Thecla).
      ** Those with the antennæ setaceous, and [slightly] plumose. Genera Barbicornis and (but erroneously) Zephyrius.

2. Those which have the posterior tibiæ furnished with two pair of spurs; the two hind wings are horizontal in repose; and the antennæ are often hooked at the tip; the caterpillars also roll up the leaves, and spin a slender cocoon of silk, wherein they are transformed into chrysalides, without angular eminences. Genus Hesperia, to which Latreille adds Urania *Fab.*

Thus it will be seen that there are five principal groups, typified by the genera Papilio, Heliconius, Nymphalis, Polyommatus, and Hesperia.

Latreille has also made various suggestions as to the correlativeness of these different groups; as, for instance, the connection of the true genus Papilio with the variegated Danaides on the one side, and the Parnassii on the other. He suggests, also, that the diurnal Lepidoptera may be divided into two principal groups, according with the suspended or girt position of the chrysalides.

By this proposed distribution of the butterflies into two principal divisions, the Erycinæ and Polyommati would be united with the Hexapoda of Latreille, an arrangement which we shall see has been partially adopted by Dr. Horsfield.

Mr. Swainson, in an attempt to arrange the butterflies according to the quinarian views of MacLeay (published in Taylor's *Phil. Mag.* March, 1827), has given the following plan of distribution, in which the first and fifth families are related in the majority of their characters; and it will be seen that they agree with Latreille's typical groups above mentioned.

1. Typical group Pupa angulated	Pupa suspended; anterior legs imperfect		1. Nymphalidæ.
	Pupa braced, and naked	anterior legs perfect	2. Papilionidæ.
			3. Hesperiidæ.
2. Aberrant group	Pupa braced, and folliculated		
	Pupa braced; larvæ onisciform; anterior legs semiperfect		4. Polyommatidæ.
	Pupa suspended; anterior legs imperfect		5. Heliconiidæ.

Here we find, however, the Hesperiidæ intervening between the Papilionidæ and Polyommatidæ, which agree in their braced naked pupæ; and, notwithstanding the relation of such insects as Leptocircus Curius*, and many of the tailed Erycinidæ and Theclæ.†

Dr. Horsfield, whose views upon the distribution of the butterflies are founded upon a very comprehensive view of the characters of the insect, in all its stages, and especially with reference to the quinarian, circular, and analogical principles of MacLeay, has divided the section

* Mr. Swainson places this insect in the genus Urania! (*Zool. Illustr.* pl. 106.)

† In the *Zool. Illustrations* (fol. 135.) Mr. Swainson has given the following as the five families of butterflies: —

1. Typical. Papilionidæ.
2. Subtypical. Nymphalidæ.
3. Aberrant. Hesperiidæ, Erycinidæ, Satyridæ.

(to which Dr. Horsfield gives the *family* name Papilionidæ*), into five stirpes, each supposed to be connected with the two adjoining, and the terminal to be in like manner allied to the first, so as to form a circle; these stirpes being named in accordance with their supposed analogies with the Ametabolous orders, and following each other in the same order as the latter occur in the *Horæ Entomologicæ*, p. 390. 392., the Ametabola not only pointing out the natural order of various minor subdivisions, but representing many annulose forms in their simple elementary state. These analogies, although employed by MacLeay, especially with reference to the Coleoptera (see *antè*, vol. i. p. 39.), are much more clearly exemplified in the Lepidoptera; and hence Dr. Horsfield considers that all the various forms of the larvæ of the diurnal Lepidoptera can, without exception, be reduced to the five stirpes described below, which are constructed according to the plan of the orders of the Ametabola.

The first, or VERMIFORM stirps, has the *larva* of an oblong linear form, attenuated at both ends; in some cases depressed, or slightly convex; in others cylindrico-gibbous, appearing to consist of numerous scuta or shields, distinctly divided by transverse striæ, having a small retractile head, and very short, scarcely perceptible feet, and is of a sluggish appearance. These larvæ bear a strong analogical resemblance to some of the Vermes (considered by MacLeay as possessing the least complicated structure), but having a more apparent analogy to the osculant group in the neighbouring circle of the Crustacea, which comprehends Oniscus, Armadillo, and Asellus. Dr. Horsfield found five varieties of the metamorphoses of this stirps in Java. The *pupa* is obtuse at both ends, particularly at the anterior; is nearly smooth, and is vertically suspended in the same manner as in the typical stirps; its head upwards, either erect or bending forwards, fixed by the tail and girt across the middle. The perfect insect is also comparatively simple, the whole of the stirps having been comprised in the lowest rank of the Linnæan arrangement under the name of Plebeii rurales, many of which are nevertheless exceedingly beautiful. The palpi are slender and of great length, extending in

* It will be seen that the nomenclature of Dr. H. is at variance with that of MacLeay; the latter dividing the order Coleoptera into five primary groups, named from their analogical resemblance to the orders of Ametabola; whilst Dr. H. names the primary groups as families in idæ, and the secondary groups from such analogical resemblance.

Myrina to the middle of the antennæ; the third joint either naked or covered with minute scales; the antennæ gradually clavate, or with a thickened compressed club abruptly inflected or bent outwards; the feet are slender, the anterior pair never spurious, perfect, and alike in both sexes; the hinder wings entire, or tailed; the body small, slender, and compressed; and the proboscis short, or moderately long.

This stirps comprises the normal genera Petavia (nearly related to the Hesperiidæ, and forming the transition from the Anopluriform to the Vermiform stirpes), Polyommatus, Lycæna, Thecla, and Myrina; aberrant genus, Symetha.

In the CHILOGNATHIFORM or IULIFORM stirps, the *larvæ* (which are considered as typical of the whole of the order Lepidoptera) are long and cylindrical, attenuated at both ends, and transversely striated as in Colias (at the confines of the Vermiform stirps, thus determining the natural situation of this genus), or regularly cylindrical and slightly hairy, as in Pieris and Pontia, or distended about the fourth or fifth segment of the body, and tapering gradually towards the tail, and more abruptly to the head in the typical group, the true Papiliones, acquiring tubercles, which in the remote genera increase in length, and show the gradual transition, through Euplœa and Heliconia *, to the Chilopodiform stirps which succeeds; the head is attached to the body by a very small articulation, and appears, when exserted, separated from it; behind it is a bifid fleshy organ or furcula. The *pupa* is attached, as in the preceding stirps, but it has peculiarities of greater perfection: it is naked and angulated, terminated in the typical forms at the upper extremity by two processes, in those near the Vermiform stirps by one short process alone; those approaching the next stirps have the suspension of that group. The *imago* is considered by Dr. Horsfield as the perfection of the whole order, the stirps comprehending as it does the Papiliones Equites and Danai of Linnæus, and his Heliconii standing at the immediate confines in the succeeding group: their wings also (according to Jones in *Linn. Trans.*) being more perfectly nerved †, the palpi in the typical species

* The analogy between the larva of Heliconia and Craspedosoma, which is intermediate between the Chilopoda and Chilognatha (see *Horæ Ent.* p. 351.), determines the situation of the former genus in the Lepidopterous circle between the Chilopodiform and Chilognathiform stirpes.

† In a preceding page Dr. Horsfield expressed the opinion that Iulus was the

are shorter than the head, their third joint is very minute, and they are concealed by a very dense covering of long bristly hairs. In Papilio they are never exserted; in Colias, near the preceding stirps, they are moderately long; in Terias an evident diminution is apparent, and in the following genera the decrease is more sudden. Polyommatus Phædrus *Latr.* appears to form a natural connecting link between Myrina (belonging to the Vermiform), and Colias (to the Chilognathiform stirps); the feet are generally long and robust, and the whole of them are perfect, and fitted for walking; the antennæ are marked with defined rings at the numerous joints, are elongate, filiform at the base, and terminated in the typical group by a cylindrical club attenuated at both ends. The normal genera belonging to this stirps are, Colias, Gonepteryx and Papilio (divided into three sections), and the aberrants are Terias, Pieris, Pontia, Leucophasia, Licinia, Thais, Doritis, and Zelima.

In the CHILOPODIFORM or Scolopendriform stirps, the appendages of the *larvæ*, noticed as simple and fleshy on the body of those of Euplœa and Heliconia *, become rigid and armed with transverse spines,

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typical form of the order; the Iuliform stirps consequently becomes the perfect type of the diurnal Lepidoptera. Dr. Horsfield, however, adduces no other grounds for this superiority than the position assigned to these insects by Linnæus, and the more perfect veining of the wings. Mr. Newman, however, denies this superiority to Papilio, considering Bombyx Atlas as the centre of all Lepidoptera; the group Phalæna, combining in itself types of the other primary divisions which Papilio does not, and, moreover, possessing the characters which Mr. Newman assumes to be pre-eminently those of the lepidopterous type, viz., an insect without antlia or palpi, with very pectinated antennæ, and enormously expansive wings, and nocturnal flight. If indeed we admit the least perfectly organised individuals in an order to be its types, there may be good ground for such a selection of characters; but I confess that I should have selected for the types of the order those in which the mouth is best developed, and in which there is the least diversity in the sexes. The females of some of the Bombycidæ are as imperfect as their larvæ (Oiketicus, Psyche), and in many their imperfect development is indicated by their sluggish habits, occasioned by a deficiency or inertness of sense: the true type of any group must of course possess the characters of such group in the highest state of development, and it will of course be the farthest removed, or bear the slightest resemblance or relation to the conterminous groups. M. Boisduval observes, "si comme dans d'autres branches de la Zoologie, on voulait mettre en tête les individus d'une organisation supérieure, on devrait commencer par les Sphingides." (*Hist. Nat. Ins. Lep.* p. 169.)

* These two genera are considered to form the transition between this and the preceding stirpes; their larvæ having a striking affinity with the Chilopodiform stirps.

which are said to cause irritation when touched similar to the bite of a Centipede, which they also resemble in their terrific appearance. This spinose character, which is but slightly developed in Melitœa, more strongly in Argynnis, and which reaches its maximum in Vanessa, is pre-eminently typical of the stirps, and clearly distinguishes it from the next stirps which has been united with it by most entomologists. The *pupa* is naked and angulated, greatly diversified on the surface, and ornamented with golden or shining dots, and it is generally suspended by the tail, with the head directed downwards. The palpi of the *perfect insects*, which are the types of the stirps, project beyond the head, the last joint being distinct and downy; the antennæ are of moderate length, with an abrupt club, broad and compressed in the typical species; the anterior feet are spurious and imperfect, and applied to the under side of the thorax. Vanessa is typical of this stirps, which passes off to the next by Apatura, Limenitis, &c. The normal genera are Euplœa, Idæa, Acræa, Vanessa, Cynthia, Melitœa, Argynnis, Biblis, Limenitis, and the aberrants Heliconia, Hetæra? Libythea and Neptis?

In the THYSANURIFORM stirps the *larva* is characterised by two rigid setæ or spines, varying in length and size, appended to the posterior extremity of the body, and pointing directly backwards, as in the Lepismæ. The *pupa* is smooth, shining, diversified in form, and attached by the tail only. The *perfect insects* are remarkable for the prevalence of a brown colour, which in many species assumes a brilliant blue gloss; their palpi and feet nearly resemble those of the preceding stirps; their antennæ are filiform, with a slender and very gradually incrassated club, which occupies a very large portion of their entire length. The normal genera are Apatura, Paphia, Amathusia, Morpho, Melanitis, Hipparchia, Nemeobius (forming the transition to Erycina?), and the aberrants are Cethosia and Brassolis. This

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This gradual change of character which takes place in the metamorphosis of the second stirps, as it approaches the confines of the third, is confirmed by the structure of the anterior feet, Heliconia and Idea forming the union, having an intermediate character, these organs being abbreviated in both these genera; the tarsi not distinguishable into five joints, but the joints being united, and their situation indicated by several spines crowded together; but on entering the Chilopodiform stirps, the anterior feet of both sexes are constructed on a different plan, not being, as in Colias and some of the Vermiform stirps, partially reduced in size, but spurious and imperfect.

stirps, it will accordingly be seen, is founded almost exclusively on the two anal appendages of the larvæ.

In the ANOPLURIFORM stirps, the *larva* is characterised by a head comparatively of excessive size, and by the abrupt posterior termination of the body, without any caudal appendage. The *pupa* is not naked as in the other stirpes, but is concealed by a cocoon, or by a covering of a convoluted leaf, and its surface is smooth, resembling that of the nocturnal Lepidoptera. The characters of the *imago* are variously modified in the Erycinæ *, which approach the preceding stirps, in the Hesperiæ, the types of the present, and in the Uraniæ, which Dr. Horsfield also adds to the stirps. They however remain for fuller investigation hereafter. The typical genera belonging to this stirps, are Erycinæ, Emesis, Danis, Lemonias, Eurybia, Hesperia, Thymele, Helius, Pamphila, Ismene, Tamyris, and the aberrants Nymphidium, Helicopis, Urania, and Barbicornis. The connection between the Anopluriform and the Vermiform stirps is considered as evident, from Linnæus having termed the one Plebeii urbicoli, and the other Plebeii rurales. The circular progression of these five stirpes, and their various affinities manifested by the larvæ, are ingeniously illustrated by a diagram exhibiting the most prominent forms of each of the stirps, and of some of the aberrant forms indicating their gradual approach to each other.

I have thought it advisable to give this sketch of Dr. Horsfield's work, not only from the importance of the views which it contains (without, however, entirely concurring therein), but also from the work being unfortunately in but few hands.

M. Boisduval, an author, who has long, and almost exclusively, studied the Lepidoptera, has published another distribution of the butterflies. He admits, however, the impossibility to form an arrangement in a continuous series, from the *many* relations which each group, both of genera and species, possesses, of which he gives several striking instances, especially the genus Pieris of Latreille; some species of which (genus Leptalis) completely resemble Heliconii; others (genus Euterpe) "se lient insensiblement" with certain species of Papilio; others "offrent un certain rapport" with the Parnassii (Doritis), whilst

* Whilst the feet in the typical Anopluromorpha are perfect, Erycina at the confines of the preceding stirps has the feet of the males spurious, whilst they are perfect in the females, thus strikingly exemplifying the transition.

others "passent insensiblement" to Colias, and others to Danais. He likewise founds his arrangement upon a consideration of the characters of the larva, which have often "plus de valeur" than those of the imago, although ordinarily the one confirms the other. The following is an abstract of his arrangement of the Rhopalocera, or diurnal Lepidoptera, which he forms into three sections and fifteen tribes.

Section 1. SUCCINCTI. Chrysalis attached by the tail, and also girt.

A. Six feet in both sexes; caterpillars elongate.

Tribe 1. *Papillonides* [more properly Papilionides]. Anal edge of hind wings concave; ungues simple.

Tribe 2. *Pierides*. Anal edge of hind wings without concavity; ungues with one tooth, or bifid.

B. Six feet in both sexes; caterpillars very contracted.

Tribe 3. *Eumenides*. Larvæ unknown; last joint of palpi much shorter than the second.

Tribe 4. *Lycenides*. Larvæ onisciform; ungues very minute.

C. Four feet in the males, and nearly always six in the females; caterpillars contracted.

Tribe 5. *Erycinides*. Ungues very minute.

D. Four feet in both sexes; caterpillars elongated.

Tribe 6. *Peridromides*. Caterpillars with spinose elongations; chrysalis very angular; ungues slightly bifid.

Section 2. SUSPENSI. Chrysalis suspended only by the tail.

A. Ungues of tarsi simple. (Four legs in both sexes.)

Tribe 7. *Danaides*. Caterpillars with from one to five pairs of simple fleshy prolongations; wings broad.

Tribe 8. *Heliconides*. Caterpillars spiny throughout their whole length; wings narrow, long.

B. Ungues of tarsi strongly bifid. (Four legs in both sexes.)

Tribe 9. *Nymphalides*. Caterpillars spiny throughout their whole length, or attenuated behind with spines only on the head; anal edge of hind wings forming a gutter; discoidal cell always open.

Tribe 10. *Brassolides*. Caterpillars thick, pubescent, often with 2 anal points, and spined on the head; anal edge of hind wings forming a strong gutter; discoidal cell always closed.

Tribe 11. *Morphides*. Caterpillars spiny, attenuated at the extremity; wings broad; anal edge of hind pair forming a gutter; discoidal cell always open.

Tribe 12. *Satyrides*. Caterpillars attenuated, nearly fish-shaped, with 2 anal points; head rounded or bifid above; discoidal cell always closed; nervures of fore wings often dilated at the base.

Tribe 13. *Biblides*. Caterpillars spinose, terminated by two anal points; palpi long, antennæ linear; anal edge of hind wings scarcely prominent, costal nervure of fore wings dilated at base.

E. Four feet in the males and six in the females; caterpillars elongated.

Tribe 14. *Libythides*. Caterpillars not spiny, slightly pubescent; chrysalis short, scarcely angular; palpi very long, beak-like.

Section 3. INVOLUTI. Chrysalis enclosed in a cocoon; antennæ distant at the base, six feet in both sexes; caterpillars with the neck narrowed.

Tribe 15. *Hesperides.*

The tribes Erycinides and Nymphalides require a more correct investigation into their preparatory states, so that it will, perhaps, be considered necessary still further to split them; thus the larva of Vanessa and Apatura, in the latter tribe, are very different. M. Boisduval commences the arrangement with the genus Papilio, although he considers it would be natural to commence the series with the Tetrapoda, as is the custom amongst the German Lepidopterists, and to place the Hexapoda before the Hesperides. In this case the Suspensi would commence the series, and the Succincti would precede the Involuti; but, as it is impossible to arrange all these genera in a continuous line, it is immaterial with which the arrangement is commenced. Dr. Horsfield, we have seen, commences his arrangement with the Lycænides, or Vermiform stirps, considering them the most simple of the whole tribes of butterflies; but, as he adopts the circular views of MacLeay, it is equally immaterial from what point of the circle he starts.

After this revision of the arrangements of the chief modern Lepidopterists, my account of the different groups into which the butterflies are divisible must necessarily be short. Anxious to place the classifications of the different orders on the same footing, I shall not, with Dr. Horsfield, adopt primary divisions with the family termination in idæ and secondary divisions named from analogical relations, neither shall I, with Boisduval, adopt so great a number of tribes, founded, in many cases, as it seems to me, upon characters which, although in one part of the order they may possess great weight, in others become almost valueless. More especially shall I hesitate to admit the propriety of regarding as distinct groups such as agree together in the general characters of the perfect state, but disagree in the form of the larvæ. This latter, we have seen, is the chief character of one of Dr. Horsfield's stirpes, whereas the single genus Papilio possesses several very striking forms, and Doritis (Parnassius) is as much entitled to a primary rank as Hipparchia, its caterpillar being much farther removed, even from the Papilionideous type, than that of Hipparchia, possessing, although the latter does, a forked tail, like a Lepisma. It will be seen, on reviewing the arrangements noticed above, that whilst Papilio, Lycæna, Nymphalis, and Hesperia are ad-

mitted on all hands to be types of distinct groups, others regarded as of primary importance by some writers are considered by others either as subordinate or osculant forms; thus, Hipparchia (Satyrus *Latr.*), treated as a distinct type by Horsfield and Swainson, is considered as subordinate by Latreille and Boisduval; whilst Heliconia, regarded as a primary group by Swainson and the French writers, is thought by Horsfield to be osculant. Erycina is another of these perplexing groups respecting which so little is in truth known; and which has accordingly been placed with the Hesperidæ by Horsfield, and with the Lycænidæ by Swainson. In the following arrangement I have endeavoured to combine the views of my predecessors. I accordingly consider the Heterocera as formed of two primary groups, named Nudi and Involuti, from the naked or covered condition of the chrysalis, answering to the genera Papilio and Hesperia of Fabricius, regarding the characters exhibited by the latter or the family Hesperiidæ in all its stages as of far higher rank than those of any of the other groups. The Nudi I divide into the following families:— 1. Papilionidæ, including the Pierides; 2. Heliconiidæ, comprising the Danaides; 3. Nymphalidæ, including the Hipparchiidæ (Satyrides *Boisd.*, or Thysanumorpha *Horsfield*) as well as Boisduval's 10th, 11th, and 13th tribes; 4. The Erycinidæ; and, 5, the Lycænidæ. A progression through these various families has been already shown by Dr. Horsfield to exist between the Papilionidæ and Heliconiidæ: from these to the Nymphalidæ, and thence by Hipparchia to Erycina, the progression is natural, whilst Erycina is intermediate, according to Latreille, between Hipparchia and Lycæna. Between this last tribe and the first or Papilionidæ (both having girt pupæ), Polyommatus Phædrus is regarded as the connecting link by Dr. Horsfield, and thus the Involuti (fam. 6. Hesperiidæ) would be thrown out of the circle were we to adopt this regular series, unless we adopt Mr. Swainson's plan, and consider it as intermediate between the Polyommatidæ (Lycænidæ) and the Papilionidæ.

The first family PAPILIONIDÆ *Leach* comprises the giants of the diurnal tribes, and is distinguished by the perfectly ambulatory structure of the fore legs in both sexes (*fig.* 95. 1. Papilio Machaon ♂*); the ungues distinct and simple, or bifid; antennæ having a

* All the figures upon this block (95. *antè*, p. 332.) represent details of Papilio

distinct club, but never hooked at the tips, and the girt condition of the chrysalis (except in Doritis); the discoidal cell of the hind wing is closed. The other characters of the family, which is equivalent with Dr. Horsfield's Iuliform stirps, will be found in a preceding page (341.) in the account of his arrangement.

This family comprises two very distinct subfamilies or tribes, as they are called by Boisduval; namely, the Papilionides and Pierides.

In the Papilionides the anal edge of the hind wings is concave or folded. The middle longitudinal nerve of the fore wings posteriorly emits four nerves, whereas there are only three arising from this nerve in all the other butterflies. They have the palpi very short (*fig.* 95. 3.), not extending in front of the eyes, with the third joint scarcely distinct; the club of the antennæ (*fig.* 95. 7.) forms an elongated mass; the ungues are entire and simple; the wings are broad with the discoidal cell always closed; the abdomen free and not received in a gutter. The caterpillars (*fig.* 95. 9.) are slow, cylindrical, thickened, never villose nor hairy, with two retractile tentacles placed on the neck, in the shape of a fork, arising from a common tubercle, and which the insect throws out when alarmed, emitting at the same time a disagreeable odour; by this means the larvæ are supposed to keep the Ichneumons at a distance.

There is considerable diversity in the appearance of the larvæ of the restricted genus Papilio (excluding Ornithopterus); some, as P. Machaon, are cylindrical and smooth; others (P. crassus) are protected by rather long fleshy prominences; others (P. Polydorus *Horsfield*, pl. 3. f. 17.) are short and thick, with numerous short fleshy points, and some resemble snails (P. Podalirius *Curtis*, B. E. pl. 578.), and a very great number (P. Arjuna *Horsfield*, pl. 4. f. 11., P. Pammon *Ibid.* pl. 3. f. 2.) have the two anterior segments attenuated, and capable of being retracted under the third and fourth, which are dilated and ornamented with eye-like spots, like those of some of the Sphingidæ. The larva of P. dissimilis (*Horsf.* pl. 8. f. 1.) is

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Machaon; 95. 2., the head from above; 3., ditto sideways; 4., the labrum, mandibles, and base of the maxillæ; 5., the labium, the base of one of the labial palpi, and base of one of the maxillæ, to show the rudimental palpus; 6., the labium, with one of the labial palpi; 7., tip of antennæ; 8., fore leg of the male; 9., caterpillar, with the nuchal tubercle exposed, attached by the tail, with a girth round the middle of the body ready for pupation; 10., the pupa.

furnished with recurved points, a pair on each side of the five joints following the first, and a single one on each side of the following segments. The larva figured by Mad. Marian as that of Pap. Protesilaus, has all the characters of one of the Nymphalidæ, such as Argynnis.

The larvæ of the Ornithopteri, at least judging from Dr. Horsfield's figure of that of P. Amphrisius (O. Heliacon *Bdv.*), has the segments armed with thick, obtuse, fleshy prominences, and each of the retractile nuchal tentacles is enclosed in an external case.

The species of Papilionides are for the most part tropical; four species only are found in Europe, two of which, P. Machaon and P. Podalirius, have occurred in England.

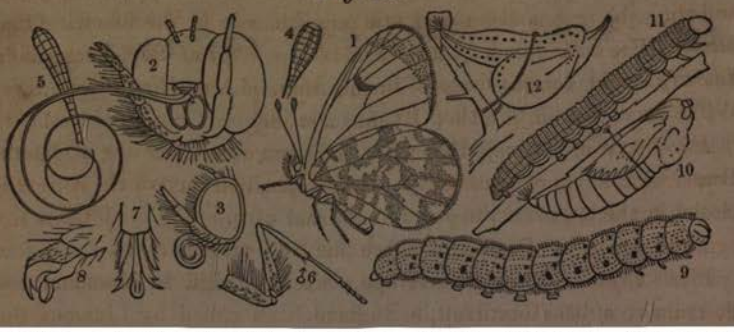
These insects, from the beauty of their colours and large size, were styled Equites by Linnæus. Many of the species have the hind wings produced into a pair of tails, whence they have obtained the name of Swallow-tails. Their flight is rapid. Some of these insects, placed by Linnæus in his two sections Equites Trojani and Achivi, have been since discovered to be but the sexes of one species; thus Mr. MacLeay possesses a specimen, the right side of which is Pap. Polycaon, a male Greek, and the left Pap. Laodocus, a female Trojan (*Linn. Trans.* vol. xiv. Append.). An instance of two Greeks thus united is described in the *Encycl. Méthod.*, the right side being Pap. Ulysses, and the left Pap. Diomedes.

Doritis *Fab.* (Parnassius *Latr.*) is especially interesting, from the form of the larva, which has more the appearance of that of one of the Bombycidæ than of a Papilio *Linn.* Its neck is also furnished with a retractile tentacle; and the cocoon is enclosed in a loose cocoon of leaves fastened together, the chrysalis being apparently attached also by the tail. The females are also furnished with a large corneous valve at the anus. The species frequent alpine regions, D. Apollo being a reputed British species.

M. Duponchel has published a notice relative to the genus Thais, some individuals of which remained two seasons in the chrysalis state, being the only instance on record of such an occurrence amongst the butterflies. (*Ann. Soc. Ent. de France*, 1835, p. 661.)

The subfamily Pierides comprising the Danai candidi of Linnæus or the families D. and E. (larvæ medio-striatæ and pallidiventris) of the *Weiner Verzeichniss* (*fig.* 96. 1. Mancipium Cardamines), is at once distinguished from the preceding by the hind wings

Fig. 96.



forming a gutter for the reception of the abdomen. The palpi are porrected, with distinct joints (*fig.* 96. 2. represents the head of Pontia Rapæ, with the palpi opened, one of them being denuded in this figure; the minute labrum and mandibles are perceived above the base of the spiral maxillæ, the two large oval bases of which are attached to the head as well as the labium, from the sides of which the large labial palpi take their rise; *fig.* 96. 3. head of the same insect seen sideways; *fig.* 96. 4. tip of antennæ of ditto; 96. 5. ditto of Gonepteryx Rhamni); the fore legs are long and perfect, without the dilated spine (*fig.* 96. 6.); the ungues are bifid, often with a long pulvillus and a narrow hirsute appendage on each side (*fig.* 96. 7, 8. ungues, &c. of Pontia Brassicæ); the caterpillars are finely pubescent and attenuated at each end without any nuchal tentacle (*fig.* 96. 9. larva of Pontia Brassicæ; 96. 10. larva of Gonept. Rhamni); the chrysalides angular, slightly compressed, and terminated in a point at each extremity, so as in some species to assume the appearance of a curved canoe (*fig.* 96. 10. pupa of Pieris Crataegi; 96. 12. ditto of Gonepteryx Rhamni).

These insects, which include our common well-known white garden butterflies, never acquire the size, nor are they equal in beauty nor so varied in their colours, as the preceding subfamily; white, orange, and brimstone being their prevailing tints. The last-named insects are, however, occasionally very destructive, the larvæ feeding for the most part upon cruciferous plants, and especially attacking the garden species, stripping cabbages, &c. of their leaves. These species, which compose the genus Pontia of Stephens, are either extremely variable, or several species have been confounded together. Mr. Stephens has supported the latter opinion by various statements relative to the

period of the appearance, food, &c. of the different supposed species; and the subject has been and still continues to be discussed. (See *Illustr. Haustell.* vol. i. p. 17—24. 146.; *Curtis*, the *Naturalist's Library*; and various papers in the *Mag. of Nat. Hist.* by the Rev. W. T. Bree, vol. iii. p. 242.; Rennie, No. 8.)

Fig. 99. 1, 2, 3. (copied from Herold) represents the egg of Pontia Brassicæ, the young caterpillar in the position in which it is enclosed in the egg, and the same in the act of bursting forth from the egg, the covering of which is subsequently devoured by it.

Pieris Cratægi, the black-veined white, although so abundant and destructive on the Continent, as to have been called by Linnæus the pest of gardens, is of considerable rarity in this country. According to Godart its larvæ live in society under a silken web, in which they form small cases to secure themselves against the winter, and which they only quit at the arrival of spring, returning to it at night.

The males in the genus Colias exhibit a character overlooked by entomologists, which serves well to distinguish the species. It is a kind of glandular sac placed upon the anterior edge of the hind wings near their base. It is large in C. Edusa, small and lenticular in C. Myrmedone, and wanting in C. Hyale and Chrysothome, &c. (*Ann. Soc. Ent. de France*, 1836, p. xi.)

M. Rambur has published an account with figures of the transformations of the Spanish Pontia Eupheme (forming his genus Zegris), which differs from all the rest of this subfamily, and approaches the Dorites in having the chrysalis enclosed in a "réseau de soie assez fort." (*Ann. Soc. Ent. de France*, 1836, p. 576.)

The larva of the Indian Pontia Belisama (Horsf. *Lep. Jav.* pl. 4. f. 10.) is clothed with long slender hairs, thus differing from the rest of the family.

The second family, HELICONIIDÆ, including Boisduval's two tribes Danaides and Heliconides (*fig.* 97. 6. Heliconia Lycoides *Bdv.*), is distinguished from the former by the small size of the fore legs (*fig.* 97. 3. fore leg ♂, 4. ♀ of Euplœa Plexippus *Linn.*), and from the following by the fore tarsi being articulated in the typical species. The tarsal ungues are large, entire or bifid, and with a long and generally bifid appendage on each side (*fig.* 97. 5. ungues of hind feet of Euplœa Plexippus; 97. 11. ditto of Heliconia Callicopis). The

Fig. 97.

discoidal cell of the hind wings is always closed (*fig.* 97. 9. hind wing of Heliconia diaphana); the antennæ are slightly clavate (*fig.* 97. 10. tip of antennæ of Heliconia); the palpi are short, and wide apart at the base (*fig.* 97. 7. head of Heliconia diaphana); the second joint being generally clothed with hairs directed upwards at its extremity (*fig.* 97. 8.); the wings vary in shape, but are often very long and narrow. The caterpillars are cylindrical and either spinose (*fig.* 97. 12. larva of Acræa Violæ), or furnished with several pairs of long fleshy appendages; that of H. Euterpe is robust and depressed, with a series of long fleshy lobes; that of H. Calliope short and cylindrical, clothed with slender spines and tufts of hair. Those of H. Psidii are smooth, and that of H. Ricini is covered with very long white hairs. That of D. Plexippus *Linn.*, *Cramer*, *Say*, and *Peale* (*Lep. Americana*, pl. 7. Archippus *Smith* and *Abbot*) is pale, with zebra-like marks, and two long retractile horns arising from the second and last segments of the body (*fig.* 97. 1.). The chrysalides, moreover, are only suspended by the tail; they are often ornamented with brilliant golden spots (*fig.* 97. 2. pupa of Danais Plexippus *Linn.*; 97. 13. pupa of Acræa Violæ.)

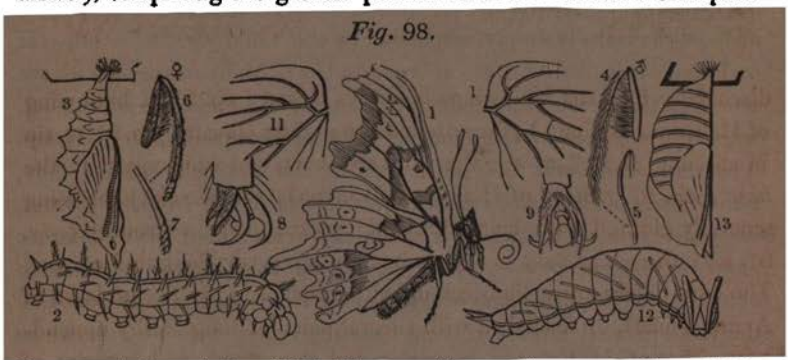
These insects are much more varied in their colours than the Pierides, but cannot vie in splendour with the Nymphalidæ. They are entirely exotic, of a moderately large size. In many of the species the wings are but slightly covered with scales, and even in a very few species they are quite denuded (H. diaphana).

M. Lacordaire's observations upon such of these butterflies as inhabit French Guiana (*Ann. Soc. Ent. de France*, 1833) are very interesting. A curious circumstance has been recently published relative to one of the species Euplœa (Danais) hamata *MacLeay*, an

inhabitant of New Holland, where it abounds to such an extent, that it is employed as an article of food by the natives, who call them Bugong, and collect them by bushels, and then bake them by placing them upon heated ground. (Bennett's *Wanderings*, vol. i. p. 265.; Kirby, *Bridg. Treat.* vol. ii. p. 350.)

The third family, NYMPHALIDÆ *Swainson* (*fig.* 98. 1. Vanessa C. album), comprising the greater portion of Dr. Horsfield's Chilopodi-

Fig. 98.



form, and the whole of his Thysanuriform stirps, as well as Boisduval's families Nymphalides, Brassolides, Morphides, Satyrides, and Biblides, and probably also his Peridromides* (Per. Arethusa *Bdv. Hist. Nat. Ins. Lep.* pl. 7. c. 5.; P. Amphinome *Linn.*, *Cramer*, 54. E. F., South America), and Libythides†, is distinguished by the rudimental structure of the fore legs in both sexes‡ (*fig.* 98. 4, 5, 6, 7.),

* Although agreeing in the general characters of the imago with the Nymphalidæ, this genus has the chrysalis girt across the middle, like that of Papilio, according to Lacordaire. (*Ann. Soc. Ent. France*, 1833, p. 392.)

† The angulated outline of the wings and the structure of the tarsal ungues in the interesting genus Libythea correspond with those of the typical Nymphalidæ. The caterpillar, however, resembles that of Pieris, but the pupa is simply suspended by the tail; the females, also, according to Boisduval, have six feet, whilst the males have only four. The discoidal cell of the hind wings is described as open by Boisduval, but it is figured as closed in the new edition of the *Règne Animal.* (*Ins.* pl. 136. *f.* 1. *e.*) The great length of the palpi is not sufficient to raise it to the rank of a distinct family or tribe. This genus is therefore intermediate between the Nymphalidæ and Eucheira socialis *Westw.*, which, although having a simply suspended chrysalis, is furnished with six feet. It is, therefore, as an aberrant group of Nymphalidæ that this latter genus ought probably to be ranged.

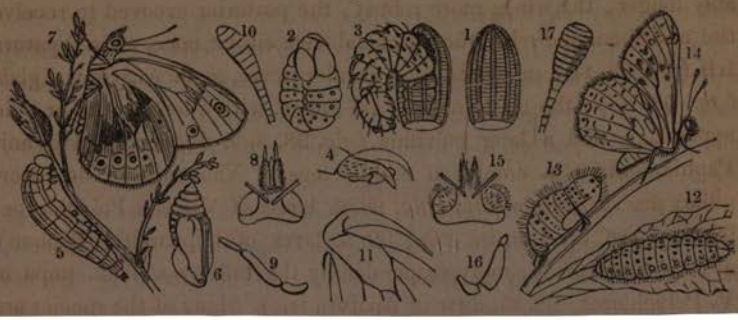
‡ In the Argynnes, the fore legs of the female, although small, have the tarsi composed of five distinct joints, each armed with a pair of minute spines (*fig.* 98. 4. and 5. fore leg ♂; 6 and 7. fore leg ♀ of Argynnis Paphia).

which are thickly covered with hair; the labial palpi are proportionably longer; the wings more robust; the posterior grooved to receive the abdomen, and with the discoidal cell either open, as in Apatura Iris (*fig.* 98. 11.), or closed by a slender nerve, as in Argynnis Aglaia (*fig.* 98. 10.); the tarsal ungues are entire, with a long entire or bifid appendage, and a long pulvillus (*fig.* 98. 8, 9. ungues of Argynnis Paphia, and 99. 4. ungues of middle legs of Vanessa). The caterpillars are variable in form (*fig.* 98. 2. larva of Vanessa Polychloros; 98. 12. larva of Apatura Iris; 99. 5. larva of Hipparchia Typhon), and the chrysalis is simply suspended by the tail (*fig.* 98. 3. pupa of V. Polychloros; 98. 13. ditto of Apatura Iris). Many of the species are amongst the most beautifully varied in their markings and colours, whence the names of the Linnæan sections Nymphales, Ocellati, and Phalerati, and such English names as the peacock, painted lady, Camberwell beauty, and red Admirable butterflies. In many species, the under side of the wings is splendidly ornamented with numerous pearl or silvery spots. These have from this spotted appearance obtained the English name of Fritillaries, from the spotted flower of the same name. Others of them have the upper surface of the wings adorned with the most splendid silvery blue, belonging to the genus Morpho, which comprises also some of the largest of known butterflies. Others are of a changeable gloss of intense purple in the males (Apatura Iris, or the purple emperor). A very few species, also, have the hind wings produced into several tails, whence they were placed by Linnæus amongst his Equites (Charaxes Jason* *Linn.*). These two last-named groups have the head of the larvæ armed with strong horns, the body naked, and the tail furcate (*fig.* 98. 12.).

The species forming the genus Hipparchia (Satyrus *Latr.*; *fig.* 99. 7. Hipparchia Typhon; 8. head of ditto; 9. palpus of ditto denuded; 10. apex of antennæ; 11. base of hind wing) have the larvæ (*fig.* 99. 5. larva; 99. 6. pupa of H. Typhon) also distinguished by the latter character; they are, however, of a feeble construction in the imago

* M. Duponchel has published an interesting memoir on the transformations of this insect (*Ann. Soc. Ent. de France,* 1837), from which it appears that the mode in which its caterpillar undergoes its moultings differs materially from that of other butterflies, the head, from its peculiar form, being disengaged and cast off entire some time before the rest of the body is denuded: its transformations are also described and figured in the *Fauna Regn. Napoli.*

Fig. 99.



state, and cannot bear comparison with the former, which are the most robust and active of lepidopterous insects. The caterpillars of this numerous genus confine themselves to the various kinds of grasses. It is only, however, during the night that they feed; and some species, according to M. Marloy (*Ann. Soc. Ent. France*, 1838), not only retire to the earth to undergo their chrysalis state, but those of H. Circe, Briseis, Semele, and Fidia form large oval cocoons, composed of grains of earth mixed with a little silk. Those of H. Mæra and Janira, however, suspend themselves by the tail. M. Duponchel has published a memoir on this genus in the *Ann. Soc. Ent. de France*, 1833, p. 97., in which he divides the species into nine groups, founded upon the characters presented by the antennæ and nervures of the wings. M. Lefebvre has also published a revision of the marbled whites (Leucomelaniens) in the same *Annales* (tom. i. p. 80.).

M. Vaudouer has published some curious observations upon the lethargy of the caterpillars of Melitæa Dia, and Euphrosyne. Some caterpillars reared from eggs of the latter insect, when about a month old, fell into a lethargic state at the end of June, in which they remained until the following spring: a few, however, revived in August, and became butterflies the same autumn. The same experiment made upon the caterpillars of M. Dia produced the same result. Hence appears the reason why these butterflies are so common in spring, whilst so few are found in autumn. (*Ann. Soc. Linn. Paris*, September, 1827.) The caterpillar of Aconthea primaria (*Horsfield*, pl. 8. f. 6.) is a most singular creature, having a very great analogy with Scutigera, each side of each segment being furnished with a very long and slender setose filament, half as long as

the entire body. The caterpillars of Vanessa (*fig.* 98. 2.) are armed with long and rough spines, arranged in transverse whorls upon the segments, except the first. Those of the fritillaries are also similarly armed, but have two long spines on the neck. Those of Limenitis* have the segments furnished with fascicles of hair down the sides; and several of the segments have also a pair of obtuse hairy spines on the back.

The species of this family are extremely liable to sport into varieties. This is especially the case with the Hipparchiæ, in some species of which scarcely two individuals are alike. The fritillaries, also, are very subject to vary; and the varieties have occasionally been described as distinct. Several interesting varieties have been figured by Curtis, Stephens, and by the Rev. W. T. Bree (*Mag. Nat. Hist.* vol. v. p. 667. and 749.).

Mr. Newport has described and figured some singular minute papillæ arising in great numbers upon the extremity of the maxillæ of V. Atalanta, as well as the hooks by which the two maxillæ are held together. (Art. "Insecta," in *Cycl. Anat. Phys.* 1839, p. 35.)

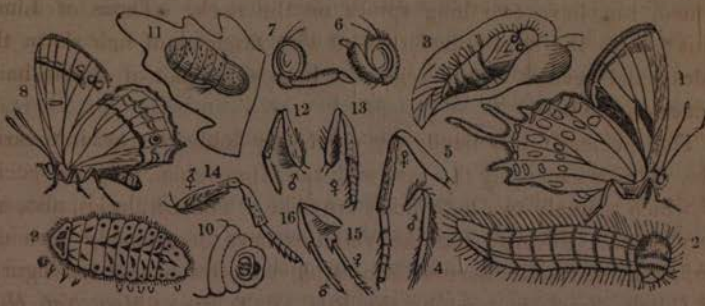
M. Wesmael has described and figured a singular gynandromorphous individual of Argynnis Paphia, in which the right side has the characters of the ordinary male, except that the outer margin has a row of spots as in the female. The fore wing on the left hand exhibits "un mélange de la coloration du mâle et de celle de la variété femelle, *le valaisien*;" and the hind left wing is exactly coloured as in the female of that variety. (*Bull. de l'Acad. de Bruxelles*, tom. iv.) Ochsenheimer has described a nearly similar individual of the same species. In my late travels on the Continent, M. Wesmael, of Brussels, showed me a specimen of Nymphalis Populi, described and figured by him in the same work, which, although arrived at the perfect state, still retains the head-cover of the larva, beneath which he discovered the cephalotheca of the chrysalis, and beneath this the head of the imago.† (*Ibid.* tom. iv. No. 8.)

* M. Duponchel has published a memoir upon Limenitis Sibilla, with figures, in the *Annales Soc. Linn.* Paris, 1827. Mr. Curtis's figure of the larva of L. Camilla is asserted by a writer in the *Entomol. Mag.*, No. 18., not to belong to that species.

† Muller, in *Der Naturforscher*, st. 16., has described a similar circumstance occurring in one of the Noctuidæ.

The fourth family ERYCINIDÆ (*fig.* 100. 1. Erycina (Helicopis) Cupido) is distinguished by the males having only four ambulatory

Fig. 100.



feet, whilst the females have six; or, in other words, the fore legs of the males are rudimental (*fig.* 100. 4. fore leg ♂, 100. 5. ditto ♀ of Emesis Drupadi *Horsf.*); the anal edge of the hind wings is but slightly prominent, the discoidal cell is either open or closed, either entirely or partially, by a false nervure. The claws of the tarsi are minute, and scarcely perceptible; the caterpillars are very short, pubescent or hairy, and the chrysalis is short and contracted; that of Erycina (Helicopis) Cupido is encased in a curled-up leaf (*fig.* 100. 3.), the larva (*fig.* 100. 2. after Stoll) having a large head, and being clothed with long hairs. The larva of Erygona Midas is very short and thick, with a large head, armed with two upright sharp horns. These insects, which are almost exclusively confined to South America, are of small size, and often of very brilliant colours; their colours are also often very varied, and their wings are marked with spots. Some of the species have the hind wings produced into two * or more tails, often of very great length, thus resembling the genera Papilio and Thecla; others in the form of their wings bear a certain resemblance to the Hipparchiæ, Heliconii, Nymphales, &c. Their flight, according to M. Lacordaire, is very rapid, and the majority of the species rest with their wings extended on the underside of leaves. M. Boisduval introduces into this family the genus Nemeobius *Steph.* (Pap. Lucina *Linn.*, *fig.* 99. 14.; 15. head; 99. 16. palpus; 99. 17. tip of antenna of ditto), an extremely interesting British species, differing in many important

* M. Morisse has published a monograph of some of the species with two long tails (genera Erycina, Diorina, and Zeonia *Bdv.*), in *Ann. Soc. Ent. France*, 1837, pl. 14.

respects from the family Nymphalidæ, in which it is arranged by Stephens, with the remark, however, of its varying therefrom. It is true that the general appearance, colours, and markings of the butterfly seem to indicate a relation with Melitæa; but the imperfect structure of the fore legs in the male, whilst they resemble the others in the female, the minute simple ungues, the posterior tibiæ destitute of spurs, the onisciform larva (*fig.* 99. 12.), and the girt chrysalis (*fig.* 99. 13.), are characters indicating a much closer relation to some of the Erycinæ.

One of the most curious species in the family is the Barbicornis Basilis *God.* (*fig.* 101. 5.; 6. head and antenna; 7. palpus; 8. foreleg), an inhabitant of Brazil, and remarkable for the anomalous structure of its antennæ; the veins of its wings agree, however, with those of most of the Erycinæ, as figured by Boisduval.

The fifth family, Lycænidæ *Leach*, Polyommatidæ *Swainson*, or the Vermiform Stirps of Dr. Horsfield (*fig.* 100. 8. Thecla Quercus) comprises a numerous assemblage of small and weak, but beautiful butterflies, distinguished by the minute size of the tarsal claws, the apparent* identity in the fore tarsi of both sexes, the fore legs being fitted for walking; the last joint of the palpi is small and naked (*fig.* 100. 6. head of Polyommatus; 7. ditto of Myrina); the anal edge of the hind wings slightly embraces the abdomen; the discoidal cell of the hind wings is apparently closed by a slender nerve. The caterpillars have a great resemblance to woodlice (*fig.* 100. 9. larva of Thecla Quercus; the points beneath indicate the situation of the head and feet; and *fig.* 100. 10. represents the three terminal segments seen beneath, which are soldered together on the upper side), and the chrysalis is short, obtuse at each end, and girt round the middle as well as attached by the tail (*fig.* 100. 11.). Several distinct groups exist in this family, namely, the Blues, Polyommati; the Coppers, Lycænæ; and the hair-streak Butterflies, Theclæ. Some

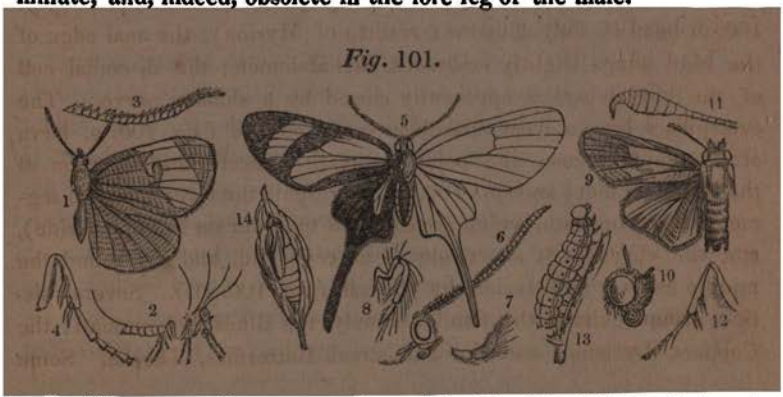
* The tarsi of both sexes have been described by Horsfield, Curtis, &c., as identical; but, in examining Thecla Isocrates, I discovered that the tarsi of the males consist of a long, simple joint (*fig.* 100. 12. ♂, 13. ♀ fore leg), and I subsequently found the same to be the case in the Polyommati (*fig.* 16. ♂, 15. ♀ fore tarsus of Pol. Corydon). *Fig.* 100. 14. is the middle leg of Thecla, alike in both sexes, exhibiting the femoral spur and tibial notch.

of the latter especially have the hind wings produced into very long tails. The majority have the entire under surface of the wing, or, at least, the anal angle, ornamented with eye-like spots of various colours. The flight of these insects is feeble and slow.

Dr. Horsfield has especially investigated the transformations of many of these insects, in his *Lepidoptera Javanica*, the larvæ of which vary very considerably in their form, some exhibiting much less resemblance to woodlice than others; some are very rough on the upper surface of the body, and that of Thecla Xenophon has several rows of fascicles of hairs. They have hitherto been observed to feed only upon the leaves of different trees and plants in the larva state; but a beautiful Indian species (Thecla Isocrates *Fabr.*) resides within the fruit of the pomegranate, several (seven or eight) being found within one fruit, in which, after consuming the interior, they assume the pupa state, having first eaten as many holes as there are insects through the rind of the fruit, and carefully attached its footstalk to the branch, by a coating of silk, in order to prevent its falling (Westwood in *Trans. Ent. Soc.* vol. ii. p. 1.).

Dr. Horsfield has figured a singular genus with its details (Symetha Pandu *H.* pl. 2. f. 2.) from Java, in which the basal joint of all the tarsi forms a very broad and long plate, the other joints being very minute, and, indeed, obsolete in the fore leg of the male.

Fig. 101.



A still more curious genus, figured by Dr. Horsfield, and placed by him as one of the normal genera of the present family, although forming the transition to the Hesperiidæ, is Petavia (P. Sakuni, *fig.* 101. 1.; 2. body sideways, showing the feet; 3. apex of antennæ; 4. hind leg, Polyommatus Petavius, *Encycl. Méth.*).

The sixth family, HESPERIIDÆ, corresponding with the Plebeii Urbicoli of Linnæus (*fig.* 101. 9. Hesperia Comma), is a very distinct tribe of butterflies, constituting, indeed, a primary division, INVOLUTI, approaching, in many respects, to the moths, as already indicated. The six feet are of uniform size in both sexes, the hind tibiæ having a pair of spurs at the apex, and another pair near the middle of the limb (*fig.* 101. 12. hind leg); the lower wings are generally horizontal during repose *; the antennæ are wide apart at the base, and are often terminated in a very strong hook (*fig.* 101. 11.); and the labial palpi have the last joint very small; the maxillæ are exceedingly long (*fig.* 101. 10. head sideways).

The caterpillars, of which, however, but few are known, are cylindrical without spines, with the anterior segments narrowed, and the head very large; they roll up leaves (Poey, *Cent. Lep. Cuba*, pl. 4., H. Papinianus), in which they construct a very slender silken cocoon, wherein they are transformed to chrysalides, which are entire, without angular prominences (Swainson, *Zool. Illustr.* vol. i. t. 16., Ismene Œdipodea). These chrysalides are further attached by the tail as well as girt round the middle (*fig.* 101. 13. larva, and 14. pupa, of H. Tages, enclosed in a silken cocoon, after Guérin.).

The species are of comparatively small size, and of obscure colours, but some are ornamented with pellucid spots, and others have the hind wings furnished with long tails.

These butterflies have the body very robust, and their flight is accordingly very strong and peculiar, whence they have obtained the name of skippers, indicative of their peculiar short jerking kind of flight. They frequently settle on flowers, leaves, or branches. H. Tages (according to Dr. Abbott, *Linn. Trans.* vol. v. p. 276.) flies early in the morning, its flight being extremely short and very near the ground. Mr. Curtis mentions the curious circumstance, that old specimens, when alive, have frequently lost one or both of their palpi, an accident he had only observed amongst the Pyralidæ.

Réaumur has figured the transformations of H. Malvæ (*Mém. Ins.* tom. i. pl. 11.), the caterpillar of which rolls up leaves, forming them into an oval ball for the period of pupation. The history of various other species is represented in Abbot and Smith's work on the Lepidoptera of Georgia.

* In some species all the wings are horizontal when at rest (Tamyris Zeleucus *Fab., Swains. Zool. Ill.* vol. i. pl. 33.)

The second general section of the Lepidoptera, that of the HETEROCERA *Boisd.*, corresponding with the Linnæan genera Sphinx and Phalæna, derives its name from the diversified formation of the antennæ, which are never terminated by a club, like those of the butterflies, but are generally setaceous, filiform, or fusiform, those of the males being moreover often furnished with more or less developed lateral appendages, forming branches; the wings are ordinarily furnished with the spring and socket apparatus, above described: the caterpillars are even more varied than in the Rhopalocera, but the pupæ are generally of a conical form, without angular projections, and they are ordinarily enclosed in a cocoon of varied construction, the quiescent state being often undergone in the ground. The group thus constructed will be seen to correspond with the genus Phalæna alone, of the earlier editions of Linnæus's *Systema Naturæ;* with the sections Crepuscularia and Nocturna of Latreille, and with the Crepuscularia, Pomeridiana, Nocturna, Semidiurna, and Vespertina of Stephens.* (See *antè*, p. 325.)

It is here most especially that we have to lament our great ignorance of exotic groups in their preparatory, as well as of their precise structure in the imago states; and it is owing to this that we are unable to form due notions of the relative value of the characters upon which the various primary groups of moths have been constructed, and are thereby prevented from defining these various groups so accurately as is done in other and better studied tribes; for instance, it is impossible not to be convinced, upon the most casual glance, that the four groups, of which the Crepuscularia have been composed, are held together by the slightest ties, and yet we are not sufficiently acquainted with the general grouping of the Nocturna to decide upon the propriety of cutting up the former group, and placing its dismemberments amongst them, or retaining them as a heterogeneous group. Urania, Castnia, Agarista, Sphinx, Ægeria, and Anthrocera (Zygæna *Fab.*), are groups of equal value amongst themselves; and on account of the peculiar conformation of their antennæ, they were united into one group by Linnæus, who, it is well known, considered this character as of the highest importance. Take, for instance, the three English groups, Sphinx, Ægeria, and Anthrocera, and we

* Mr. Bird (*Ent. Mag.* vol. ii. p. 40.) has objected to Mr. Stephens's employment of these terms, having captured the males of a vast number of the Pomeridian genera during the night, they having been attracted to the light of a lamp.

find the first isolated; the second, in its fenestrated wings, approaches some of the Sphingidæ, but its metamorphoses are totally different, resembling those of Cossus; whilst Anthrocera, on the other hand, is, in its preparatory states, a Bombyx, and in its final one probably intermediate between Macroglossa and Pyralis; Ægeria, nevertheless, is not farther removed from Sphinx than is Castnia or Urania, nor than Hepialus or Lithosia are from Attacus, in the tribe of Bombycidæ. Geometra, Tortrix, Noctua, &c., in their extended state, are groups admirably defined, and yet it is impossible to look at Euclidia, Acosmetia, Nola, or Platypteryx, without perceiving, either that we must extend the limits of our families, so as to admit these anomalous groups, or else must create a far greater number of families than has hitherto been done. The works of foreign authors, who have elsewhere so materially tended to forward our acquaintance with the insect tribes here (that is, more especially amongst the smaller European, as well as the Exotic tribes), give us but little assistance. On reviewing the sketch given in a previous page (p. 325.) of Mr. Stephens's arrangement of these groups, we find them to correspond nearly with the Linnæan grouping *, but I cannot understand wherefore Lithosia is introduced into the same group with Noctua, whilst its legitimate station seems to be intermediate between the aberrant Bombycidæ and the Yponomeutidæ; neither can I understand why Pyralis is united with Geometræ, agreeing neither in habit nor transformations. Platypteryx, on the other hand, agrees with Geometra in the habit of the imago, but in its transformations it is much nearer to Cerura amongst the Bombycidæ. As to the Vespertina, comprising all the minute moths, they may be said to be still in a state of chaos, as any one may be convinced by comparing the works of Haworth, Curtis, and Stephens,

* Mr. Stephens's arrangement of these tribes is exhibited by him in the following sketch, published in the Introduction to his *Systematic Catalogue*, with a view to prove the circular distribution of the order: —

Ægeriidæ: Sesiidæ.		Papilionidæ: Nymphalidæ.
II.	Sphingidæ: Hesperiidæ.	I.
Zygænidæ.		Lycænidæ.
Notodontidæ: Hepialidæ.		Geometridæ: Platyptericidæ.
III.		V.
Bombycidæ: Arctiidæ.		Pyralidæ.
	Lithosiidæ: Tineidæ.	
Noctuidæ	IV. VI.	Tortricidæ.
	Pterophoridæ.	Yponomeutidæ.

and the little unity of principle existing between them, or by examining the lists of the minute tribes given by continental authors, who, content with the showy objects in the order, almost overlook the minute, but highly interesting, and often exquisitely beautiful species. If we cast our eyes over the sketch of the distribution of these tribes, given by Dr. Horsfield (see *antè*, p. 328.), we shall find still less reason to be satisfied, either as regards the primary or the secondary groups. Compare, for instance, the Sphingidæ, where four *genera* are regarded as primary types of form, with the Phalænidæ, where each type of form is of as a high a rank as the whole of the Sphingidæ.

If the arrangement of Dr. Horsfield, founded as it is upon the quinarian principles of MacLeay, presents us with too few primary groups amongst the moths, that of Latreille is, on the other hand, to be guarded against as establishing too many, in other words as regarding as primary groups those which are only secondary. He distributes the Crepuscularia into four primary sections, and the Nocturna into ten, namely, 1. Hepialites. 2. Bombycites. 3. Pseudo-Bombyces (Arctiidæ, Notodontidæ, and Lithosiidæ). 4. Aposura (genera Cerura and Platypteryx). 5. Noctuelites. 6. Tortrices. 7. Phalænites. 8. Deltoides (Crambus rostratus *Fabr.*, &c.). 9. Tineites, including Botys, Galleria, and all the small moths except, 10. Pterophorites. This arrangement of the families appears to me on the whole more natural than any other hitherto proposed, and especially than that of the German naturalists. The section Aposura ought, however, to be rejected, consisting as it does of two genera, having no other relation than that their larvæ are destitute of anal feet; the Tortrices also unnaturally break the transition from the Noctuidæ to the Geometridæ so beautifully effected by Catocala, Plusia, and other half-loopers, as their larvæ are termed, and Ophiusa, Erastria, &c. Again, the 9th tribe, Tineites, requires further dismemberment. With regard, therefore, to the primary groups of the Heterocera, I candidly admit that I am not able to offer a satisfactory classification, although it seems unquestionable that Sphinx (or the hawk moths), Bombyx (or the feather-horned full-bodies), Noctua (or the thread-horned full-bodies), Geometra (or the loopers), Pyralis, Tortrix, and Tinea, are, as Linnæus considered them, amongst the primary types. I shall, therefore, proceed to the consideration of the secondary groups or families independent of their primary tribes, which may be arranged as fol-

lows: 1. Sphingidæ. 2. Uraniidæ. 3. Anthroceridæ. 4. Ægeriidæ. 5. Hepialidæ. 6. Bombycidæ. 7. Arctiidæ (including the Notodontidæ). 8. Lithosiidæ. 9. Noctuidæ. 10. Geometridæ. 11. Pyralidæ. 12. Tortricidæ. 13. Yponomeutidæ. 14. Tineidæ. And 15. Alucitidæ.

I leave it as a matter undecided whether the Uraniidæ be nearer related to the butterflies than they are to the Anthroceridæ. Should the former opinion be maintained (as in the arrangement of Latreille), the family ought to precede all the rest. I cannot, however, with Latreille, introduce them amongst the true butterflies.

The first family SPHINGIDÆ * comprises the most robust and powerful insects in the order, generally distinguished by their strength of flight (whence their English name hawk moths) and large size. The spiral tongue is often extremely long, exceeding the whole body in length in some species; (*fig.* 102. 14. Macroglossa stellatarum, with the spiral tongue extended; 102. 1. head of Deilephila Celerio); the antennæ are prismatic, and terminated by a little feather, or thread (*fig.* 102. 5. apex of antenna of Acherontia Atropos; 102. 6. transverse section of antennæ of Sphinx Ligustri after Newport); the labial palpi are broad and compressed, and closely covered with scales, the terminal

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M. Lefebvre de Cerisy, several years ago, prepared a monograph of the Sphingidæ, with figures (for which he obtained very considerable materials from the collection of Mr. Haworth); but this monograph has never yet been published.

Fig. 102.

joint being generally almost indistinct (*fig.* 102. 4. lab. palpi of Deil. Celerio); the labrum and mandibles are minute (*fig.* 102. 2.); the maxillary palpi are minute and 3-jointed in Sphinx Celerio (*fig.* 102. 3.) and Ligustri, according to Savigny and Newport; the body is long, and acute behind, the wings, especially the hinder pair, small; the caterpillars are naked, cylindrical, and 16-footed; they are ordinarily furnished with a short horn on the back of the eleventh segment; they are also ornamented with pale oblique stripes upon the sides of the body (*fig.* 102. 9. larva of Smerinthus Tiliæ). They descend into the earth to become pupæ, which are naked, conical, and often furnished with a detached horn, containing the spiral tongue, extending upon the breast (*fig.* 102. 12. pupa of Sph. Ligustri), which is, however, wanting in those species which have the tongue short (*fig.* 102. 13. front of body of pupa of Smerinthus Tiliæ). The wings are retained in their situation during flight, by means of the spring and socket above described (*fig.* 102. 8., and see *ante*, p. 318.). Various modifications occur in the characters of the imago in this family. The antennæ in Smerinthus are serrated and ciliated, especially in the middle and in the males; the labial palpi have the second joint slender in Daphnis Nerii, but very much swollen in Deilephila and Smerinthus. The maxillæ vary considerably in length, exceeding that of the entire body in Sphinx, but scarcely exceeding that of the head in the Death's-head hawk moth (Acherontia Atropos *fig.* 102. 7. head of ditto), and in Smerinthus not longer than the labial palpi; this variation in length corresponds with the rapidity of flight, and the habit of the insects of extracting the nectareous juices of tube-bearing flowers by means of their elongated tongue. The extremity of the abdomen is, in some species, elongated, and very

acute, and in others broader, and furnished on each side with a brush: others, again, vary from the types of the family by having the wings more or less denuded of scales (Sesia), whence the species, which are of smaller size than the typical species, have received the names of S. fusiformis and bombyliformis, in allusion to their analogical resemblance to drones or Bombylius. These last-mentioned species, as well as those with tufted abdomens, fly during the day, the latter thence obtaining the name of humming-bird hawk moths; whereas the others fly during the twilight, darting about with the greatest rapidity, or hovering, hawk-like, in front of flowers, from which they extract the nectar with the assistance of their elongated tongue. Mr. Stephens has separated these day-flying species as a distinct family, Sesiidæ; but the identity in their more decided characteristics, and especially the conformity in their preparatory states*, are sufficient to prove them to belong to the same natural group, constituting, however, so many aberrant genera: thus, whilst Macroglossa bears a relation to certain Noctuidæ, Sesia approaches Ægeria; some of the Smerinthi, especially from North America, approach certain Bombycidæ, in which we also find an equal diminution in the length of the spiral tongue, and in which the hind wings in repose extend beyond the fore wings at the sides: thus, we perceive that the preparatory states afford the best characters of the family.

The caterpillars of the typical species are remarkable for the attitude which they ordinarily assume, whence they have obtained the generic name of Sphinx, from their supposed resemblance to the figures of that fabulous creature. Some of these caterpillars are also remarkable for the faculty they possess of elongating and contracting the three anterior segments of the body, giving them somewhat the appearance of the proboscis of an elephant, whence they have obtained the name of elephant sphinxes. By the French they are named *chenilles cochonnes* (*fig.* 102. 10. and 11. front of body of larva of Metopsilus Elpenor). It will be seen by referring to a preceding page (328.), that Dr. Horsfield divides the Sphingidæ (which he considers

* Sesia (S. bombyliformis, &c.) is certainly the most aberrant genus in the family, the caterpillars being slightly pilose; and when about ten days old, they have several furcate spines upon each segment of the abdomen, that entirely disappear when they are full-fed, according to information given by Mr. Dale to Mr. Curtis. The full-grown caterpillar is however evidently Sphingideous. The perfect insects make a loud humming during flight.

as one of the five primary sections of the Lepidoptera) into five groups, of which four are represented by the genera Macroglossa, Smerinthus, Acherontia, and Sphinx, whilst the fifth has for its type the very distinct genus Zygæna. This arrangement cannot, however, be considered a natural one, since the four first-mentioned genera possess distinctive characters, *inter se*, of far slighter value than those which separate Zygæna from any of them; in other words, these four genera are but types of genera in one family, whilst Zygæna is the type of a distinct family. The larvæ of the Smerinthi are, it is true, covered with minute granular tubercles, and the head is conical, but surely these are the characters of a genus, and not of a stirps or family. In a very few species the caudal horn of the larva is nearly or entirely obliterated, as in the North American Sphinx Coniferarum (Abb. and Smith's *Lepid. of Georgia*, vol. i. p. 42.), a species closely allied to Sph. Celerio and Plebeia, placed by Mr. Stephens in the same group with the true elephant moths, but which, in this respect, is as far removed from them as the Sphinges Euphorbiæ and Galii, which have been miscalled spotted elephant hawk-moths.

With respect to the mode in which they undergo pupation, there is a slight variation, the majority descending into the earth, and forming an oval cell, whilst a few form a leafy cocoon on the surface of the ground. In their perfect state they offer no other variation in habits, than as connected with their more or less powerful or sluggish movements, or with the crepuscular or diurnal period of their flight.

The Death's-head moth (*Acherontia Atropos*) is the largest European Lepidopterous insect, and derives its name from the singular skull-like patch on the back of the thorax. This marking, together with the shrill sound which the insect emits when alarmed, has rendered it an object of alarm to the ignorant in seasons when it has abounded, as in 1826, when the most ridiculous statements appeared in the public prints respecting them. This noise has been the subject of much investigation, which must still be considered as unsettled. By Réaumur and Roesel it was supposed to be caused by the friction of the labial palpi against each other; and by Passerini, that it was produced within the head, in which is a cavity connected with the spiral tongue (*Osservazioni, &c.* Pisa, 1828; and *Ann. Sci. Nat.* vol. xiii. p. 332.; and *Bull. Sci. Nat.* February, 1829; and ditto,

February, 1831.). M. de Johet attributes it to the action of the air being suddenly impelled against the scales at the base of the wings by the action of the latter (as cited by Engramelle). Such is also the opinion of Vallot (in *L'Institut*, 1834, p. 4.), whilst M. Lorey attributes it to the escape of a current of air through certain cavities at the base of the abdomen, which are furnished with a beautiful pencil of hairs. M. Goreau has also described this apparatus as the cause of the sound. (*Ann. Soc. Ent. France*, 1837. p. 69.)

It is to be observed, however, that this opinion, supported as it is by analogy with the Cicadæ, appears to be negatived by the fact, that many mute Lepidoptera are furnished with these cavities and pencils of hairs. (See my figures of Noctuidæ.)

This gigantic insect has the habit of frequenting the hive for the purpose of robbing the bees of their honey, as described by Kuhn, Huber, and others; these authors conjecturing that the hostility of the bees is disarmed by the noise emitted by the moth. This moth, when it bursts from the chrysalis, has its wings, antennæ, and legs enveloped in a fine membrane resembling tissue paper, which prevents them from adhering, and rapidly dries, opens, and drops off as they unfold. This pellicle I regard as the analogue of the Pseudimago skin of Ephemera (see *antè*, p. 28. note). Goeze (*Der Naturforscher*, st. 17.) has published a singular variety of the larvæ of Ach. Atropos. Fuessly also figured some varieties in the larvæ of Deilephila Livornica (*Arch.* tab. 4. 33. Sph. Koechlini), supposed to be caused by the diversity of the food of the larva.

The species of Smerinthus appear to be subject in a remarkable degree to gynandromorphism, a considerable number of instances of this kind having been recorded by different authors, which I have collected in a memoir read before the Entomological Society, in which I have also described and figured some very interesting individuals reared by Mr. House, being hybrids between S. ocellatus and S. populi, which are the only instances hitherto recorded of a similar result produced by a forced union of the sexes of distinct species. I am indebted to W. Raddon, Esq. for one of these very interesting specimens. Deilephila Euphorbiæ is stated to remain in the pupa state occasionally for two years, a wise provision of nature, resulting from the habit of this insect in frequenting the sand hills near the coast, which, constantly shifting with the changes of the seasons, might destroy the entire brood were it not for such a protection.

Acherontia Atropos, on the other hand, assumes the pupa state at the beginning, and becomes an imago at the end of the autumn.

I regret that want of space prevents me from giving an abstract of Mr. G. Newport's elaborate researches in the internal anatomy of Sphinx Convolvuli *, published in the *Philos. Transactions.*

The second family URANIIDÆ † comprises several very anomalous exotic genera, which, indeed, seem so little allied together, as to render the adoption of the family provisional. Latreille named them Hesperi-Sphinges from their apparently occupying a station between the Hesperiæ and Sphinges; indeed the typical genus Urania was placed by him amongst the butterflies after Hesperia: the discovery, however, of its preparatory states proves it to belong rather to the Heterocerous section of the order, its day-flying habits not being alone sufficient to remove it from that section; the possession also of ocelli, the spring and socket of the wings, and the peculiar direction of the nerves, equally prevent it from being united with the Diurnal Lepidoptera, as Dalman well observes. The splendid colours of the typical Uraniæ are, it is true, indicative of diurnal flight, and give them, in conjunction with their form, all the appearance of a butterfly, to which the tailed hind wings add considerably; but there are other species (Nyctalemon Orontes and Patroclus and Sematura Lunus, &c. *Dalman*), which in their more sober colouring would be considered as

* An instance is recorded in the *Zoological Journal* (No. 17.), in which several males of this species were attracted to a situation where the female had passed over.

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† BIBLIOGR. REFER. TO THE URANIIDÆ.

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Gray, in Trans. Ent. Soc. London, vol. ii.

moths, and some of these seem so nearly related to Coronis, whilst Urania is in several respects so close to Agarista (in its larva, palpi, and antennæ), that I am induced to unite them into one family, a step which seems to be supported by the neuration of the wings. Even between Castnia and Urania, Mr. MacLeay has no doubt that there exists "some close kind of relation." (*Trans. Zool. Soc.* vol. i. p. 188.) How far their relation to the Anthroceridæ by means of their transformations is to be considered as closer than to the Hesperiidæ, remains for future consideration. I cannot, however, but add that Urania appears in some respects to approach Erebus, especially in the palpi*, and Mr. MacLeay notices the resemblance between the eggs of Urania and Catocala, to which last genus also Castnia must be allied. The antennæ are long, but never prismatic as in the Sphingidæ, nor terminated by a pencil of hairs, but are variable in form; in Urania they are slender, filiform, and gradually attenuated to the tip; in Coronis and Castnia, however, they are clavate at the tip; the maxillæ are elongated; the palpi are distinctly 3-jointed; in Urania and Agarista they are elongated, the second joint very compressed, and the third slender and naked; the fore tibiæ are spurred (*fig.* 103. 2.).

The accounts published of the transformations of Urania (Cydimon *Dalm.*, Leilus *Swains.*) have varied considerably; Madame Merian having described a larva and imago from Surinam supposed to be those of Urania Leilus, the former armed with very long and strong spines as hard as iron wire. M. Sganzin, on the other hand, asserts that the larva of Urania Rhipheus (Thaliura Rh. *Duncan*, For. Butt. pl. 28.) is a semi-looper, and its chrysalis naked, suspended by the tail and girt round the centre. (*Anomalie du g. Uranie par Boisduval, Ann. Soc. Ent. Franc.* 1834, p. 248., and *Nouv. Ann. du Mus.* p. 260.) But the elaborate account published by Mr. MacLeay upon the habits and transformations of Urania Fernandinæ, proves that its larva (*fig.* 103. 1.) closely resembles that of Agarista, being cylindrical with long delicate setæ, and that the pupa as in that genus is enclosed in a cocoon, but of so lax a nature as to allow the inmate to be seen. Mr. MacLeay does not mention whether the chrysalis is attached by its tail as in the butterflies; but since his return from Cuba he has been so

* I find that Fabricius had placed some of the Uraniæ with Erebus, thus anticipating my supposition of this relation.

kind as to show me the cocoon, and to inform me that the chrysalis is loose. This chrysalis is of the conical form. The flight of Urania Fernandinæ is diurnal, and exceedingly swift, somewhat like that of Apatura Iris, sporting about the topmost branches of forest trees; and when it alights, its four wings are expanded horizontally, as represented by Mr. Swainson (*Zool. Ill.*, n. ser., pl. 129.).

Agarista consists of New Holland insects, having much more the appearance of moths, but with filiform antennæ slightly thickened in the middle and terminated in a point. The transformations of A. Glycinæ have been figured by Lewin in his work on the Lepidoptera of that country (copied by Guérin, *Icon.* pl. 83., and Griffith's *An. K. Ins.* pl. 53.); its larva having considerable resemblance to that of Pygæra bucephala with slender hairs; its cocoon is elongated, attached to the twigs of the tree, somewhat like that of Anthrocera filipendulæ, but sufficiently open to allow the chrysalis to be seen through the meshes.

The transformations of Castnia and Coronis have not been observed; the former of these genera, according to Mr. Swainson (*Zool. Ill.* vol. iii. p. 149.), sits when at rest with its wings deflexed.

The third family* ANTHROCERIDÆ† (Zygænides *Latr.*) comprises a rather numerous group of species of small or moderate size, distinguished by their brilliancy of colour and diurnal flight (*fig.* 103. 3. Anthrocera filipendulæ, *fig.* 103. 12. Ino Statices ♂), having the antennæ never terminated by a pencil of hairs, and either simple in both sexes and fusiform, or thickened near the middle, nearly setaceous, and pectinated in the males (*fig.* 103. 4. tip of antenna of Anth.

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* BIBLIOGR. REFER. TO THE ANTHROCERIDÆ.

Boisduval. Essai d'une Monogr. des Zygænides, 8vo. Paris, 1829.—Ditto, Hist. Nat. Lepidopt., pl. 14, 15, 16.

Fristhamel. Descript. de la Chimera funebris, in Ann. Soc. Ent. France, 1832.

Villiers. Notice sur l'Accouplement de deux Zygènes d'espèces différentes, in Ditto.

† The name Zygæna having been preoccupied in Ichthyology, has been rejected by Mr. Stephens in favour of Scopoli's name Anthrocera; Mr. Stephens has nevertheless retained the family name Zygænidæ, which must evidently be thrown down.

Fig. 103.

filipendulæ, *fig.* 103. 13. tip of antenna of Ino Statices ♂); the head (*fig.* 103. 8. head of Anth. scabiosæ) is furnished with a pair of ocelli behind the antennæ; the labial palpi are small, or but of moderate size, with the terminal joint distinct (*fig.* 103. 11. labium and lab. palpi of Anth. scabiosæ); the maxillæ are greatly elongated (*fig.* 103. 8. 10.; *fig.* 103. 9. labrum and mandibles of Anth. scabiosæ after Savigny); the maxillary palpi are short and 3-jointed; the wings are always deflexed in repose, exhibiting in many species a number of denuded spots; the nervures are very numerous; the legs are long, with the posterior tibiæ furnished with four spurs (*fig.* 103. 5.); the abdomen is never terminated by a broad pencil of hairs.

The caterpillars (*fig.* 103. 6. larva of Anth. filipendulæ; 103. 14. that of Ino Statices) are sluggish creatures, of a cylindrical form, generally clothed with short hairs, without any spine at the hind part of the body; and considerably resemble those of several of the Bombycidæ. These caterpillars feed on various species of Leguminosæ; and, when full grown, construct a close cocoon of silk, which they attach to the stems of grass and low plants, out of the upper end of which the pupa partially works itself, as represented in *fig.* 103. 7., being the cocoon of Anth. filipendulæ. The pupæ are of the ordinary conical form, without any angular prominences (*fig.* 103. 15. pupa of Ino Statices, after Lyonnet, in whose posthumous memoirs are contained memoirs upon Anthrocera and Ino). The larva of Procris Vitis is very destructive to the vine in Tuscany. (See Passerini, *Memorie sopra due Specie d'Insetti nocivi;* and *Bull. Sci. Nat.* Feb. 1831. See also Pallas, *Travels in South Russia*, vol. ii. p. 241., quoted by Kirby and Spence, *Introd.* vol. i. p. 206.) The larva of Aglaope infausta nearly resembles that of Anthrocera; but that of

Syntomis Phegea is much more hairy, resembling the caterpillars of some of the Arctiidæ, the hairs arising in bundles. (Guérin, *Icon. R. An.* pl. 84. b.; and Griff., *An. K. Ins.* pl. 120.) M. De Villiers has published an account of the circumstances connected with the coupling of two distinct species of the genus Anthrocera, whence some of the supposed species of this genus are considered to be hybrids. (*Ann. Soc. Ent. de France*, tom. i.) In their diurnal flight and fenestrated wings, these insects appear to approach the Ægeriæ; but the relation between them appears to be but remote, as does also their supposed affinity to the Pyralidæ, the various characters between the latter seeming to indicate no higher relation than one of analogy; for nothing can be more dissimilar than the slow, heavy flight of Zygæna and the active movements of the Pyralidæ. Some of the exotic species of this family are exceedingly beautiful in their colours; and those of the genera Glaucopis and Aglaope have the antennæ strongly bipectinated in both sexes. Latreille considers them as probably allied to Callimorpha amongst the nocturnal Lepidoptera.

The fourth family ÆGERIIDÆ*, or the Sesiades of Latreille, consists of a moderate number of very interesting insects, remarkable for their great resemblance to various Hymenoptera and Diptera, owing to the elongate form of the body, and the nakedness of the wings, which are more or less transparent in many of the species (*fig.* 104. 3. Trochilium bembeciforme ♂; 104. 6. Ægeria tipuliformis ♂). The antennæ are simple, fusiform, or thickened towards the tips, and generally terminated by a small pencil of hairs (*fig.* 104. 9. tip of antenna of Æg. tipuliformis; 104. 5. ditto of Troch. bembeciforme ♂). The ocelli are distinct, and the labial palpi elevated,

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* Bibliogr. Refer. to the Ægeriidæ.

Laspeyres. Sesiæ Europææ Iconibus, &c. Berol. 1801. 4to.

Newman. Sphinx Vespiformis, an Essay. London. — Ditto, in Entomol. Mag., No. 1.

Worth, upon an Insect very destructive to Peach Trees, Ægeria exitiosa *Say,* in Journ. Acad. Nat. Sci. Philadelph. Decemb. 1823, and Ferussac Bull. Jan. 1825.

Stephens. Hubner. Engramelle, Godart, Wood, &c.

Fig. 104.

with the second joint long and slender, and the last distinct, and pointed at the tip (*fig.* 104. 4. head of Trochilium; 7. ditto of Ægeria; 8. labial palpus of Ægeria denuded). The spiral tongue varies in length, being not longer than the palpi in Trochilium; the legs are long, the posterior with very long spurs. In Trochilium, the posterior tibiæ are very thickly pilose. The abdomen is elongated, and generally terminated by a brush, capable of opening and closing at will. The wings are furnished with but comparatively few nervures.

The larvæ of these insects are fleshy grubs, of a cylindrical form, and with naked bodies destitute of a caudal horn. They have six pectoral, eight ventral, and two anal feet. They live in the interior of the branches or roots of trees, of the débris of which they construct a cocoon, or at least a partial one, in which they undergo their transformations to chrysalides, the abdominal segments of which are armed with transverse rows of recurved points, whereby the chrysalis is enabled to push itself through the cocoon, and half out of the hole in the stem, which the larva had previously made, having had the instinct to turn round in its burrow, so that the head of the pupa might be towards the orifice. *Figure* 104. 1. represents the larva, and 104. 2. the pupa of Trochil. bembeciforme (Crabroniformis *Haworth*), a species which lives upon the willow (Salix Caprea), the young wood of which it perforates occasionally to such an extent as to become a serious injury. (Bree, in *Mag. Nat. Hist.*, n. s., vol. i. p. 19., and Loudon's *Arb. Brit.* p. 1482.; Lewin, in *Trans. Linn. Soc.* vol. iii. tab. i.; and Blomer, in *Mag. Nat. Hist.* No. 21.)

The larva of a curious American species, remarkable for the diversity of the sexes (Æg. exitiosa *Say*), is very destructive to peach trees in the United States. (*Worth*, ut suprà citat.)

The larvæ of Ægeria culiciformis and Æ. formiciformis feed upon the wood of the apple, and that of Ægeria tipuliformis upon the pith of currant trees, about which the perfect insects may be seen flying, in the hottest sunshine, with great activity, or basking upon the leaves, alternately expanding and shutting their fan-like tails. (See Hayward, in *Mag. Nat. Hist.* No. 17.)

M. Boisduval has described the transformations of Thyris fenestrina in the *Annales des Sc. Nat.* August, 1828.

The species of Trochilium, on the other hand, are extremely sluggish in the perfect state, usually resting on the trunks or leaves of the trees on which they have been produced, and flying heavily; a peculiarity connected with the smallness and weakness of the spiral tongue, in which respects, as Mr. Stephens suggests, this genus approaches nearer to the Bombycidæ than Ægeria. Independent of the interest which these insects possess from their striking analogy to other insects (whence the names of hornet hawk-moths, and the specific names Crabroniformis, Tipuliformis, Asiliformis, Ichneumoniformis, Vespiformis, &c.), these insects are especially worthy of remark, on account of the difficulties connected with their natural situation amongst the Lepidopterous tribes. The ordinary location assigned to them, with the other species of Linnæan Sphinx, solely, as it would seem, from the structure of their antennæ, and the analogical relation existing between them and the clear-winged Sphingidæ, is disproved by their habits and transformations; in which latter respect they closely approach Cossus amongst the Hepialidæ. Mr. Newman, indeed, on this account introduces them into his family Cossi (including Hepialus, &c.); but there are so many characters in the imago state, in which the Ægeriæ differ from all the Hepialidæ, that I prefer following Latreille and Stephens in keeping them distinct.

The fifth family HEPIALIDÆ* is the first group belonging to the section Nocturna of Latreille (differing from his Crepuscularia in

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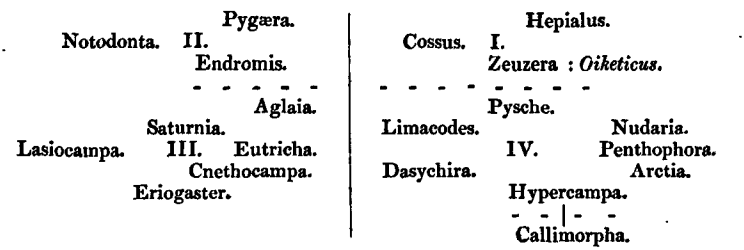
* BIBLIOGR. REFER. TO THE HEPIALIDÆ.

Lyonnet. Traité Anatomique de la Chenille qui ronge le Bois de Saule. La Haye, 4to. 1760–1762.; and the general works of *Fabricius, Esper, Hubner, Donovan, Godart, Haworth, Stephens, Wood, Cramer, &c.*

having the antennæ gradually attenuated to the tip or setaceous), and is distinguished by having the antennæ very short and filiform (*fig.* 104. 13. ant. of Hepialus Humuli ♀), never feathered to the tip; the spiral tongue is either obsolete or very short; the palpi are also generally obsolete (*fig.* 104. 12. head of H. Humuli ♀); the abdomen is elongated, as are also the wings, which are deflexed in repose, the extremity of the former being attenuated into an ovipositor of considerable length, so as to be capable of being withdrawn, or introduced into the crevices of the bark of trees, &c.; the thorax is never crested; the nerves of the wings are far more complicated than in any of the preceding groups (*fig.* 104. 16. nerves of Hepialus Humuli ♀). The caterpillars are fleshy, naked grubs, with a few straggling hairs; they are 16-footed (having 6 pectoral, 8 ventral, and 2 anal feet; *fig.* 104. 10. larva of Hepialus obliquus). They feed upon the wood of standing trees, or the roots of vegetables. When full grown, they construct a cocoon of the morsels of wood or vegetables upon which they have been feeding.

The abdominal segments of the chrysalis are armed with transverse rows of fine reflexed spines, which assist the insect whilst pushing itself to the day, immediately before assuming the perfect state.

This and the two following families constitute Mr. Stephens's group of Pomeridiana, consisting of the four families Hepialidæ, Notodontidæ, Bombycidæ, and Arctiidæ, the circular arrangement of which is proposed to be effected in the following manner (*Syst. Cat. Introd.* p. xi.).



The species of the typical genus Hepialus (*fig.* 104. 11. H. obliquus) have the antennæ very short, and either simple or serrated. They are called Swifts, from the rapidity of their flight, which takes place during the twilight; the sexes vary very considerably in appearance and structure; those of the typical species, H. Humuli, are

the most striking in this respect, the wings of the males being pure white, and those of the females yellow, varied with darker markings; the former sex has obtained the name of the Ghost moth from its peculiar habit of hovering with a pendulum-like motion for a great length of time in one situation (often in churchyards), where the female is concealed in the grass, its white colour rendering it very conspicuous: the other species are more discursive, flying about low herbage at the roots of grass. The feet in this genus are destitute of spurs, the posterior tibiæ in the males being very thickly clothed with long hairs on the outside (*fig.* 104. 14.); the same part in H. hectus is remarkably dilated, and the tarsi are wanting (De Geer and Van Heyden in *Bulletin Sc. Nat.* January, 1831,) (*fig.* 104. 15.); the mouth is entirely obsolete; the larvæ are subterranean, feeding on the roots of plants; and the females have the power of discharging their eggs singly to a great distance, with considerable force, when alarmed.

The Goat moth (Phal. Bomb. Cossus *Linn.*, Cossus ligniperda *Fabr.*) is one of the largest British Lepidopterous insects. Its large red fleshy larvæ, equalling in size a man's finger, have been regarded by Ray and Linnæus as the Cossus of the Roman epicures; it feeds upon the wood of willow trees, which it perforates in every direction, and from its size so greatly weakens them, that they are often blown down with the first strong wind; the antennæ are pectinated to the tip in both sexes; the labial palpi are present, although the other parts of the mouth are obsolete. The inimitable dissections of Lyonnet of the larva, contained in his *Traité Anatomique de la Chenille qui ronge le Bois de Saule* (4to. La Haye, 1760 and 1762), and of the chrysalis and imago, published in his posthumous memoirs, may be accounted the most elaborate and complete of any hitherto published. De Geer and Réaumur also exercised their talents upon this species. The insect, previous to bursting forth, and whilst still a chrysalis, pushes itself half out of the orifice formed by the larva, with the assistance of the spines on the abdominal segments, and the imago leaves the exuviæ thus sticking out of the trunk when it has escaped. The caterpillars emit a very strong scent, whence the English name of the moth, and also discharge a fetid liquid, which probably serves to moisten the wood. In default of their usual food, these larvæ have been observed to feed on the bodies of other insects (Duponchel in *Ann. Sci. Nat.*, June, 1831; see also Loudon's *Gard. Mag.* Nos. 78. 91. and *Arboretum Britann.* p. 1386, for further notices of its history.).

Fig. 105.

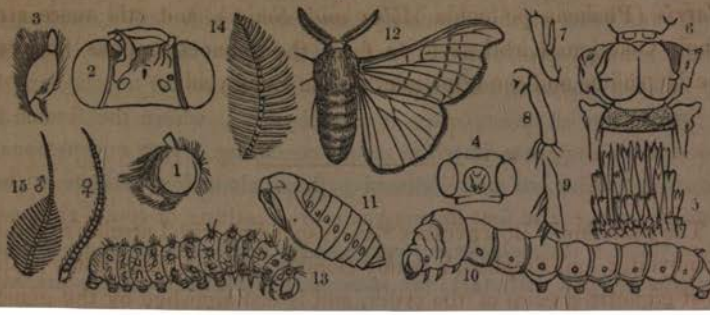


Fig. 105. 5. represents a portion of the wing of this insect, to show the manner in which the scales are arranged, and *fig.* 105. 7. the anterior, 8. the intermediate, and 9. the posterior tibiæ, to show the spurs.

The Wood leopard-moth (Zeuzera Æsculi) is distinguished by the beautiful structure of the antennæ of the males (*fig.* 105. 15. male, 16. female antennæ.) The larva of this insect feeds upon the wood of apple, pear, and other fruit trees; like that of Cossus, it is a naked fleshy grub, and has the prothorax defended above by a broad horny shield. There are notes relative to this insect, published in Nos. 6, 7, and 8. of the *Mag. Nat. Hist.*, 1st series, and *Gardener's Magazine*, Nos. 78. 91., and *Arboretum Britann.* p. 887.

The Continental genus, Stygia, placed by De Villiers (*Ann. Soc. Linn.* Paris, v. 473.) between Ægeria (Sesia) and Anthrocera (Zygæna), is considered by Latreille as more closely allied to Cossus. The situation assigned to these insects by Latreille, at the head of the Nocturnal Lepidoptera, evidently originates in the similarity of their transformations with the Ægeriidæ (although Latreille interposes the Anthroceridæ between them). There appears, however, to be but little relation in the imago state, either in respect to their habits or structure, so that it may be questioned how far the relation is more than one of analogy; at all events, I hesitate as to the propriety of placing the Ægeriæ in the same natural group with Hepialus and Cossus, as Mr. Newman has done. Mr. Stephens suggests a relation with Smerinthus, and Mr. Curtis with Stauropus through Zeuzera. Latreille, on the other hand, has always placed Saturnia immediately after Zeuzera; but I do not find that he has ever expressed any opinion on the affinity of these genera. Looking at the structure of

the imago, independent of metamorphoses, the genus Dryocampa *Harris* (Phalæna pellucida *Abbot and Smith*), and still more strikingly Oiketicus Kirbii, seem to form the connecting links between the Hepialidæ and the remainder of the Bombycidæ.

The sixth family BOMBYCIDÆ *, corresponding with Latreille's section Bombycites, and Stephens's family Bombycidæ, comprises some of the most gigantic species of the order, and is distinguished by the gener-

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* BIBLIOGR. REFER. TO THE BOMBYCIDÆ AND ARCTIIDÆ.

Germar. System. Glossat. Prodromus sistens Bombycum Species, &c. 4to. Leipzig, 1810–12.

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Disderi, in Turin Trans. vol. ii.

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Thunberg. Description of a new Silkworm from Japan (Noctua Sericis), in Neue Abhandl. der Schwed. Akad., 1781, in Swedish.

Lamare Piquot. Mémoire sur le Bombyx Paphia, ou Goutypoka des Indous, introduit dans l'Ile.

Olivier. Obs. Gener. sur les Chenilles Fileuses, et Descr. d'une Nouv. Esp. de Bombyx, in Journ. d'Hist. Nat. tom. i.

Esper. Beobacht. an einer Zwitterphalane der Bombyx Cratægi. Erlangen, 1788.

Capieux. Beitrage einer zwitter von Phal. Pavonia major, in Der Naturforscher, 1778.

Zincken G. Sommer. Ueber Sacktrager (Psyche), in Germar's Mag. d. Entomol. vol. i.

ally obsolete structure of the mouth, which is often destitute of palpi; and the maxillæ, when present, are so small as to be useless, and not spirally folded up (*fig.* 105. 4. head of Saturnia Pavonia major beneath, showing the rudimental state of the mouth; in *fig.* 105. 1., head of Bombyx (Minyas) Polygoni *Savigny*, the labial palpi, *fig.* 105. 3., are distinct, but the maxillæ, *fig.* 105. 2., are very short); the body is very thick and hairy (*fig.* 105. 6. thorax of Saturnia Pavonia major, the striated part being one of the tegulæ, and the dotted part the metathorax); the antennæ of the males are generally very strongly bipectinated to the tip (*fig.* 105. 14. antenna of Saturnia Pavonia major ♂; *fig.* 106. 1. one of the joints of ditto showing its double bipectinations); the wings are large, and either extended horizontally or deflexed at the sides, the costa of the posterior pair extending beyond that of the anterior; the thorax is not crested, the legs are of the ordinary structure; but Dalman has described a North American species (B. cyllopoda) in which the hind legs are spurious, like the fore legs of the Nymphalidæ (*Anal. Entomol. Obs.* vol. ii. p. 102.). The larvæ are naked (*fig.* 105. 10. larva of Bombyx mori), and often have a transverse series of warts upon each segment, each furnished with a diverging coronet of hairs (*fig.* 105. 13. young larva of Saturnia Pavonia minor); they are 16-footed, having six pectoral, eight ventral, and two anal feet; they do not inhabit portable cases; their food consists of the leaves of various plants. They enclose themselves in cocoons of pure silk, frequently of a firm and rigid texture, and which is rarely subterranean. The pupæ are not armed with transverse series of rigid points upon the abdominal segments (*fig.* 105. 11. pupa of Bombyx Mori). The males, according to Mr. Stephens, in general fly swiftly in the day-time, from about noon to four or five o'clock in the afternoon, and again in the evening; but the females are very sluggish and inactive. The prevailing hues are grey or fawn colour, and many of the larger species have the wings ornamented with eye-like spots.

The larger species of the family, which have the wings extended horizontally whilst in repose, were formed by Linnæus into a separate

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Guilding. Nat. Hist. of Oiketicus, in Trans. Linn. Soc. vol. xv.

Guérin, in Mag. Zool. 1831. (Descr. Gymnautocera.)

Bulletin de Ferussac, May 1831. (Bombyx Hieracium); and the general works on Lepidoptera above referred to.

section of his Phalænæ named Attacus (Saturnia, Schrank). Amongst these the giant Atlas-moth, Saturnia Atlas, from China, the S. Cecropia and Luna, which have the hind wings produced into a tail, and S. Cynthia and Mylitta, the cocoons of which are employed in India for the production of silk, are amongst the largest species. From a communication made to Latreille of a Chinese manuscript upon the subject of the silk trade, it appears that the caterpillars of these two species are the wild species of silkworm of China. The former species, B. Cynthia, is the Arrindi silkworm of India, of which, as well as of the Tusseh silkworm, Dr. Roxburgh published a long account in the *Trans. Linnæan Soc.* vol. vii. with plates. For further details relative to the last-named species, see also *Ann. Sci. Nat.* Aug. 1831, and *Bull. Sci. Nat. Ferussac*, Sept. 1831. See also Col. Sykes's Memoir on the Kolisurra silkworm of the Deccan above referred to.

Humboldt has also described a Mexican moth (Bombyx Madrono) which is social in its habits, the larva forming nests of a dense tissue and brilliant whiteness, which are employed by the natives in the manufacture of silk. (*Political Essay of New Spain*, vol. iii. p. 59.)

The fine North American species, Saturnia Promethea, exhibits an interesting peculiarity of habit in the construction of its cocoon, which it forms within a leaf of the Sassafras tree, having previously, however, fastened the stalk of the leaf to the stem by a strong silken web, whereby it is prevented from falling with the other leaves. (Peale's *Lepidopt. Americana*, part i.)

The majority of these species have the centre of the wings ornamented with a talc-like spot. Others have a large eye-like spot at the same place (Saturnia Pavonia minor, &c.). This species, which is the only example of this particular group found in England, and is one of our most beautiful moths, constructs a remarkably interesting cocoon, the extremity not being close, but terminated by a converging circle of very stiff hairs, which enables the insect to make its escape from within, but completely prevents all ingress.* The larva of the beautiful American Saturnia Luna, distinguished for the length of the

* See on the habits of this insect Loudon's *Mag. Nat. Hist.*, No. 6. A writer in the *Entomol. Mag.*, vol. iii. p. 206., has stated the curious but rather doubtful fact, that a large caterpillar of this insect having formed its cocoon, produced two winged individuals, a male and a female. Kleesius also, as quoted by Kirby and Spence, asserts that he had once two specimens of Gastropacha quercifolia,

tails of the hind wings, resembles that of the Emperor moth, except that the warts on the segments are smaller (*Abbott and Smith*).

The common silkworm (*fig.* 105. 10.), which is the larva of Bombyx Mori (*fig.* 105. 12.), is too well known to need description. According to Latreille, who has minutely investigated the history of silk culture, this moth was a native of the northern provinces of China, whence, in the reign of Justinian, it was imported by the missionaries to Constantinople, and thence to Sicily, and to other parts of the south of Europe, where it has long been an extensive object of commerce, and where the greatest care is taken in the management and rearing of it. Silkworm gut, so much used by anglers, is also manufactured from the larvæ.

It would be out of place in this work to enter into any details relative to the history of the silk trade, or of the manufacturing process. I shall therefore only allude to the remarkably sluggish character of the perfect insect, and the absence of any disposition on the part of the caterpillar to wander from the trays on which it is fed, peculiarities which eminently fit it, as suggested by Mr. Sells, for the subject of so extensive an occupation.

The following stanza relative to the habits of the silkworm in the Welsh language is a literary curiosity, being entirely composed of vowels.

O'i wiw wy i weu ê à, a'i weuau	I perish by my art,
O'i wyau a weua;	Dig my own grave;
E' weua ei we aia',	I spin my thread of life,
A'i weuau yw ieuau iâ.	My death I weave.

The silkworm has been long known in the south of Europe to be subject to a disease called muscardine, which destroys the insect, and at the same time covers the body with a white efflorescence. The real nature of this disease remained unascertained until 1835, when M. Bassi proved it to be a minute fungus (Botrytis Bassiana) in a state of vegetation, which had by degrees occupied the whole of the interior of the body, and then burst through the skin. M. V. Audouin has followed up this singular discovery by numerous experiments and mi-

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produced from one pupa, which was large, being full two inches long, and one thick. Wm. Knott, Esq. has informed me of an instance, in which two chrysalides of the Emperor moth were contained in one cocoon; and several (two, and even as many as three or four) chrysalides of the lackey-moth have been observed in a large common cocoon by Mr. Marshall, as he has himself informed me.

croscopical researches, the result of which he has published in two Memoirs in the *Annales des Sci. Nat.* for 1838.

The works of Count Dandolo on the silkworm (*Engl. Transl.*); the volume upon the silk manufacture in Lardner's *Cabinet Cyclopædia*; the American work entitled the *Silk Cultivator* by Kenrick; the valuable analysis by Dr. Ure (*Trans. Entomol. Soc.* vol. i. App. p. 50.); Latreille in *Ann. Sci. Nat.*, May 1831, and in his *Cours d'Entomol.*; a Memoir on silk worms in America in *Trans. Philadelph. Soc.*, 1786, 1789, vol. i. 2d ed., and vol. ii.; and a Memoir by Lavini in the *Turin Transact.* tom. xxxvii., 1834, may be consulted on the subject of the silk culture.

Other species, which have the palpi porrected, and the hind wings in repose extending considerably beyond the costa of the anterior, form the genus Gastropacha; G. quercifolia, the type has all the appearance of a bundle of dried and shrivelled up leaves. The larva has the sides of the body furnished with fleshy appendages, concealing the feet; it is very large and hairy, as it is also in other species, called eggar-moths, from the cocoons being smooth, firm, and oval, and exactly resembling eggs (Lasiocampa Quercus, Trifolii, &c.). M. Guenée has made some observations on the construction of one of these cocoons (that of B. lanestris), with respect to the absorption and renewal of the very small quantity of enclosed air by the chrysalis. (*Ann. Soc. Ent. de France*, 1835, App. p. 63.)

M. Villiers, in his Memoirs upon Bombyx Pityocampa and Chelonia pudica, has noticed a peculiarity in the structure of the underside of the breast, near the base of the abdomen, and which he likens to the drums of the Cicada. (*Ann. Soc. Ent. de France*, 1832, No. 2.)

Some of the species (Clisiocampa Neustria, Eriogaster lanestris, &c.) are eminently gregarious, inhabiting a general nest in the larva state, which they extend from time to time, quitting it during the night in search of food, but constantly spinning a line of silk in order to direct them on their return before morning: they finally quit the nest before changing to pupæ. Some of these remain two or more years in the pupa state, especially Eriogaster lanestris, as described by Mr. Haworth (*Lepid. Britann.* p. 125.); and others (Cnethocampa processionea) are remarkable for the regular processionary marches of their social caterpillars. (Réaumur and Nicolai, *Processions Raupe*, Berlin, 1833.) Some of these caterpillars are very handsome, being longitudinally striped with different colours, whence they have obtained

the name of lackey caterpillars. Clisiocampa Neustria has the instinct to arrange its eggs in a close spiral coil round the young branches of fruit trees.

Many of these moths are remarkable for the instinct which the males possess of seeking their females from very great distances, and in situations apparently inaccessible to them, in great numbers. This habit, which collectors call "sembling," is turned to good account when they happen to rear the females of rare species, as they are sure to secure numbers of males if the females be taken to the woods. Mr. Haworth has given an account of this habit (*Lepid. Britann.* p. 82.), and mentions an instance in which a male moth found its way into the pocket of a collector, who happened to have a female in his collecting-box. The means by which these males are apprised of the presence of their partners at such distances is at present only conjectural. Other instances are recorded, where male moths have come down chimneys. (Davis, in Loudon's *Mag. Nat. Hist.* No. 4. Jurine has also described some singular instances of this kind in his *Nouv. Méthode de classer les Hymenopt.* Pref. p. 9.)

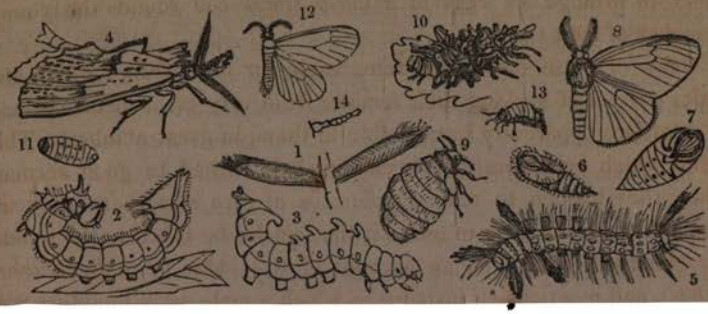
A circumstance also, of great physiological interest, has been observed with several species of these insects, namely, the production of fertile eggs without impregnation. Burmeister has collected a number of such instances (*Handbuch, Translation,* p. 312.); and M. Carlier communicated to Lacordaire (*Introd. à l'Entomol.* tom. ii. p. 383.), that he had obtained, without impregnation, three generations of Hypogymna dispar*, the last of which consisted entirely of males, which, of course, put an end to the experiment.

The transformations of many of the species of this family are illustrated in the works of Réaumur, De Geer, Rösel, Schäffer, Sepp, Hubner, Admiral, and other works expressly devoted to the metamorphosis of this order.

The seventh family, ARCTIIDÆ, with which I have united the Notodontidæ of Stephens, nearly corresponds with the third section of the Nocturna of Latreille, or the Pseudo-Bombyces, and comprises those species which have the wings deflexed in repose,

* Mr. Davis also informed me of a similar occurrence, observed by Mr. Tardy, in one of the eggar moths.

Fig. 106.



the posterior pair not extending beyond the costa of the anterior: they are connected together by a spring and socket; the antennæ of the males are strongly bipectinated or serrated; the spiral tongue is either obsolete, or of very small size; and the labial palpi are generally short, and obtuse at the tip, with the last joint very small. The caterpillars vary very considerably, being in some species naked, but variously tubercled; in others, thickly hairy; and in some, furnished with long fascicles of hairs. They feed entirely upon the external parts of plants, and enclose themselves in cocoons when about to undergo their transformations.

The family comprises many very distinct types of form, but all appear to have a connection *inter se;* whence I find it impossible to draw a line between those which form Stephens's two families, Notodontidæ and Arctiidæ. The structure of the mouth will not assist in the inquiry, because Pygæra, Cerura, &c., amongst the Notodontidæ, have the maxillæ, and even the maxillary palpi (as discovered by Curtis), developed as strongly as in Spilosoma and Arctia; whilst there is as great a variation in the transformations of the genera of either group, as there is between the respective species of the two groups; hence I have followed Latreille in keeping them under one family.

Of these insects, Notodonta and its allied species are distinguished by the fore wings being toothed, or having elevated portions along the inner margin.

There is considerable diversity in the appearance of the larvæ of these prominents, as they have been termed, but the majority are furnished with several tubercles on the back, and the anal feet are spurious in some species (*fig.* 106. 2. larva of Lophopteryx camelina;

106. 3. ditto of Notodonta dromedaria.). The larva of Endromis versicolor is also naked, with a pyramidal horn on the eleventh segment; in this respect approaching the Sphingidæ, as it also does in the ordinary position of the body, and the oblique stripes at its sides. But the most extraordinary larva in the family is that which has been termed the lobster caterpillar (that of Stauropus Fagi), and which has the second and third pairs of legs greatly elongated; the intermediate segments of the body with elevated conical tubercles; and the apex of the body is swollen, terminated by two long slender appendages, without any anal feet; and this part of the insect, as well as the head, is generally elevated in repose. Ochsenheimer, probably on account of the want of anal feet in the larva, placed this insect in the genus Cerura; but Mr. Curtis thinks it makes a near approach to Notodonta trepida, a situation which appears to me most natural, when we consider the variations in form of the larvæ of the prominent moths.

Latreille considers that some of these prominents, especially Pterostoma palpina (*fig.* 106. 4.), establish the passage between this family and the Noctuidæ, by means of the genus Calyptra (the herald moth), which he places at the head of that family. Some prominents have also the thorax crested, a peculiarity more especially found in the Noctuidæ. Pygæra bucephala also approaches the Noctuidæ in the larva burying itself in the earth without forming any cocoon. Mr. Curtis considers the last-named genus as very nearly related to the Notodontæ. Its larvæ, for some time after they are hatched, live in society, arranging themselves closely, in regular rows, upon a leaf, commencing at one end, and eating their way to the other.

The types of the family are distinguished by their larvæ being very thickly clothed with long hairs, whence they have obtained the name of *woolly bears* (*fig.* 107. 3. larva of Arctia Caja). Such are especially the larvæ of the various species of tiger moths, and others nearly allied to them. These are amongst the most beautiful of all the species of moths, the fore wings being ornamented with white and brown, or black, and the hind wings red, with black or blue markings. Some of these caterpillars are extremely destructive, from their polyphagous habits. Of these, Porthesia auriflua may especially be mentioned. This species, in 1782, abounded to such an extent, that fears were entertained for the preservation of fruit trees, hedges, and even growing corn and grass. So great, indeed, was the dread

of this new calamity, that prayers were ordered to be read in all the churches to avert its effects. (W. Curtis, *A short History of the Brown-Tail Moth.* London, 1782. 4to.) Hypogymna dispar and Psilura monacha are occasionally exceedingly destructive in Germany to the forests, which they completely strip of their foliage.

Dr. T. W. Harris has published a memoir on the American salt-marsh caterpillar (Spilosoma acria), which is equally destructive to all kinds of herbage in certain seasons. (*Massachus. Agricult. Repos.* vol. vii. 1823.)

Other larvæ (especially those of Orgyia, *fig.* 106. 5.) are furnished, in addition to the long slender hairs all over the body, with several short, thick, truncated tufts of hair on the back as well as at the sides, with several other longer and more slender tufts of hairs, each hair being thickened at the tip. (Swammerdam has published the details of the history of O. antiqua, in the 33d plate of his *Book of Nature.* See also Bree, in *Mag. Nat. Hist.* No. 10.)

Of these tufted larvæ, the majority produce species not materially differing in the sexes; but some, forming the genus Orgyia, have females with the smallest rudiments of wings, and large swollen abdomens, and which are exceedingly sluggish in their habits, whilst the males are constantly on the wing, flitting about in the hottest weather of autumn; thence, probably, termed vapourer moths (*fig.* 106. 8. Orgyia antiqua ♂; 9. ♀; 5. larva; 6. pupa ♂; 7. pupa ♀ of this insect).

M. Rambur has figured a curious species (Trichosoma Corsicum), allied to the tiger moths, having similarly spotted wings, but in which the wings of the females are not above one-third of the ordinary size, but with all the markings of the species. (*Ann. Soc. Ent. de France,* 1832. pl. 8.) In a later number of the same work he has published another species, T. Boeticum, in which the female is almost apterous (1836, pl. 19.).

The family likewise comprises several other genera, anomalous as respects their transformations. Of these, Cerura *Schrank,* or the puss and kitten moths, are the first to be noticed; these have the larvæ with only 14 feet, 6 pectoral and 8 ventral; the anal pair being obsolete, or rather converted into a furcate appendage at the extremity of the body, containing a pair of long slender filaments capable of being withdrawn or exserted at pleasure (*fig.* 107. 2. Cerura furcula; 107. 1. young larva of Cerura vinula, in a state of inaction).

Fig. 107.

Mr. Dale (*Mag. Nat. Hist.* No. 19.) makes the following singular statement respecting some of these insects:—"I once had a specimen of Bombyx Menthrastri, and six of Ophion vinulæ [ichneumons] hatched from the pupæ of Bombyx vinulus, which is certainly a curious fact." An instance is also recorded in the same work, in which the larva of Cerura vinula had been observed to exhibit electrical powers.

The larvæ of the genus Limacodes *Latr.* (Apoda *Haworth*) are interesting from the onisciform structure of their larvæ, which have the feet so short (the prolegs being retractile) as to appear destitute of legs (*fig.* 107. 4. larva, 5. cocoon, 6. pupa, and 7. imago of Limacodes Testudo; 107. 8. larva of a North American species, figured by Abbott and Smith). A remarkable species, apparently belonging to this group, is figured by Lewin in his work on the Lepidoptera of New South Wales.

The genera Oiketicus* and Psyche are remarkable for the habit which their larvæ have of constructing for themselves portable cases of bits of grass and sticks or leaves, in which they reside, and undergo their transformations (*fig.* 106. 10. larva in its case; 11. pupa of the female; 12. male imago; 13. female imago; 14. antenna ♀). In this respect these insects represent the Phryganeidæ; indeed, Mr. Newman does not hesitate to assert, that they ought to be removed from the present order. The transformations of these insects are especially interesting, and the females are entirely apterous, being in

* The Rev. L. Guilding's admirable account of this genus is contained in the fifteenth volume of the *Linnæan Transactions*. Judging from his figures, I apprehend the genus comprises two very distinct groups, P. MacLeaii appearing nearly allied to Psyche. The female never quits her case, but receives the caresses of the male whilst still confined therein.

fact, the most imperfect of all Lepidopterous insects; and even less favoured than their larvæ, which they considerably resemble. I possess some very singular cases, formed by exotic species of these genera. The male larva of Psyche, previously to assuming the pupa state, fastens its case by the mouth to the surface of leaves and stems of plants; the larva then turns, so that its head is pointed towards the opposite aperture, out of which the pupa half pushes itself before becoming an imago: the females, on the other hand, never leave their cases; and from some observations made by Ochsenheimer and Ingpen (*Steph. Illustr. Haust.* 2. p. 81.), it would appear that these females produce fertile eggs without fecundation. The relation of these insects with the Ægeriæ seems confirmed by the Sphinx ephemeræformis, an insect which Mr. Stephens has formed into the genus Thyridopteryx, next to Psyche. (*Trans. Entomol. Soc.* vol. i. p. 76.) M. Rambur has described another genus, under the name of Heterogynis, which seems intermediate between Psyche and Penthophera, agreeing with the former in the general appearance of the male, and the apterous inert female; but having a naked larva, which makes a cocoon somewhat like that of Anthrocera. (*Ann. Soc. Ent. France*, 1836, pl. 17., and *Fauna Andalus.* vol. ii. pl. 14.)

Closely allied to these insects, and apparently also to the Orgyiæ (judging from Mr. Curtis's dissections), is the genus Penthophera, the larvæ of which are described by him as tuberculated, each tubercle producing a bundle of hairs. The female of P. Morio, however, (*Ernst. Pap. d'Eur.* t. iv. pl. 134. f. 179. a–d), differs only from the male in its more robust abdomen, simple antennæ, and small wings. The females of P. detrita and rubea have the wings, however, as large in proportion to the size of the insects as those of the males.

I have seen in the collection of M. Robyns, at Brussels, a most remarkable Javanese insect, apparently belonging to this family, in which the hind wings are extremely elongated and linear, giving the insect the appearance of a Nemopteryx. M. Wesmael has described it under the name of Himantopterus fuscinervis (*Bull. Acad. Roy. Bruxelles*, 1836.).

The transformations of many species of this family are illustrated in the works of Réaumur, De Geer, Rösel, &c.

The eighth family, LITHOSIIDÆ *Stephens*, is of small extent, and difficult location, having the body slender (*fig.* 107. 10. Lithosia quadra), the antennæ generally slender and setaceous, and occasionally pectinated or ciliated in the males; the mouth is considerably more developed than in many of the preceding moths (*fig.* 107. 11. head of Deiopeia pulchella after Savigny), the maxillæ being long (with the maxillary palpi exceedingly minute and biarticulate in Deiopeia pulchella, according to Savigny) and spiral, and the labial palpi of moderate size and 3-jointed (*fig.* 107. 12. labial palpi and base of the maxillary of D. pulchella), the third joint being small, and in some cases apparently soldered with the preceding; the thorax is not crested; the wings comparatively of delicate structure, elongated, and when at rest carried horizontally, the inner margin of one of the fore wings lapping over the same margin of the other. The larvæ (*fig.* 107. 9. larva of Lith. quadra) are cylindrical, often somewhat hairy, with six pectoral, eight ventral, and two anal feet; they are solitary in their habits, never residing either in a case or in a general tent-like web. In their habits the perfect insects are weak and inactive; they fly rarely by day, although the brilliant colours of some of the species would seem to indicate a contrary habit. Their flight is short and feeble.

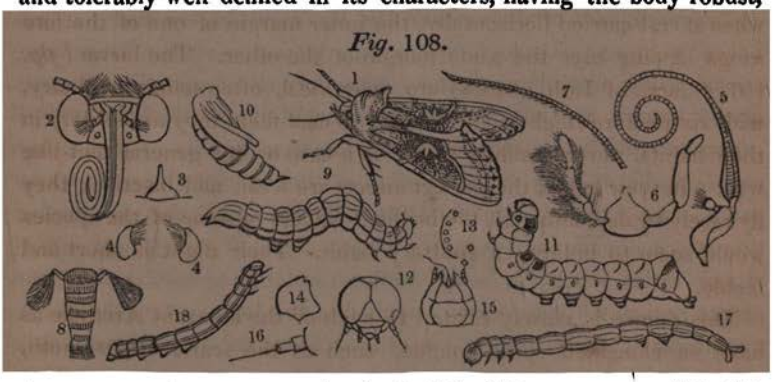
This family is closely related to such of the aberrant Arctiidæ as have an elongated spiral tongue, such as the scarlet tiger moth, Hypercompa Dominula; indeed Latreille places them as genera in one and the same group without any sectional division; they, however, make a very near approach to the Yponomeutidæ, as is evident from such insects as Eulepia cribrum and Yponomeuta Evonymella (Latreille, *Consid. Général.* p. 81.): hence, in some of his works, Latreille places his Tineites after this family, and preceding the Noctuidæ. Mr. Stephens considers them so closely allied to the last-named family, that he unites them together to form his section Nocturna; but this relation appears to me to be too slight to warrant such a step. Many very splendid exotic species appear to me to constitute a passage between these insects and the aberrant Anthroceridæ.

The larva of the beautiful Deiopeia pulchella offers a remarkable agreement with the imago in its colours being whitish with red and black spots; that of Callimorpha Jacobææ, which feeds in considerable numbers upon the ragwort, is quite different from its imago, in being dark golden coloured with black rings.

Mr. Curtis introduces into this family the genus Nudaria, placed by Stephens near Psyche; in its ample wings, however, it differs from the habit of this family, although its hirsute larva, and its transparent cocoon, in which the hairs of the larvæ are worked, agree therewith. Réaumur (vol. i. pl. 36.) and Schäffer (*Abhandl.* vol. iii. pl. 2.) have published the history of this genus with figures, overlooked by Mr. Curtis, who has also given figures of the transformations. See also *Der Naturforscher*, st. 28.

The ninth family, NOCTUIDÆ * *Steph.*, is one of very great extent, and tolerably well defined in its characters, having the body robust,

Fig. 108.



the antennæ almost constantly simple (*fig.* 108. 7. antenna of Plusia), being but very rarely pectinated or ciliated in the males; the thorax stout, and often crested; and the wings of moderate size, with strong nerves (*fig.* 108. 1. Plusia Gamma), and generally with peculiar ear-

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* BIBLIOGR. REFER. TO THE NOCTUIDÆ.

Beckwith. Hist. and Descr. of four N. Sp. *Phalænæ*, Linn. Trans. vol. ii.

Paykull, in Trans. Swed. Acad. 1786. (*Noctua telifera.*)

Eversmann, in Bulletin Soc. Nat. Moscow, 1837.

Rambur, in Annales Soc. Ent. de France, tom. iii. (*Cucullia.*) — Ditto, tom. iii. (*New Noctuæ.*)

Boisduval, in Silbermann's Rev. Entomol. vol. ii. (*New Noctuæ.*)

Guenée. Classification of the *Noctuidæ*, in Annales Soc. Ent. de France, 1837.

Boisduval, Duponchel, Pierret, Guenée, Donzel, Rambur, Memoirs on various detached species in ditto.

And the general works of *Ochsenheimer and Treitschke, Hubner, Haworth, Esper, Fabricius, Stephens, Curtis, &c. &c.*

shaped spots on the disk of the fore wings; the mouth is also well developed, the spiral tongue or maxillæ being greatly elongated (*fig.* 108. 2. front of head of Noctua (Strigina) Poæ *Sav. Egypt.*; 3. labrum; 4 4. mandibles; 5. maxilla; 6. labium and its palpi, one denuded). The wings in repose are ordinarily deflexed at the sides of the body; the labial palpi are of moderate length, terminated suddenly by a small or very slender joint, the preceding being very long and compressed. The body is clothed with scales, rather than with a coating of a woolly nature. The abdomen is of an elongate conical form, rarely so robust as in the Bombycidæ.

The larvæ exhibit several modifications, but in the majority they are naked, with sixteen feet; in some the first, and in others the first and second, pairs of the ventral feet are wanting; the anal feet are never wanting. These larvæ ordinarily undergo their transformations under ground in cocoons, often formed of particles of earth mixed in with the silk.* Mr. Stephens observes, that the typical groups of this family, as their name imports, fly only by night, and repose during the day in the crevices of the bark of trees, old walls, palings, &c.; though others not only fly by night, but also during the afternoon and at twilight. The position of the wings during repose varies much; in some groups (as Triphæna, &c.) they are placed horizontally, and closely applied to the body, giving the insect a somewhat cylindrical form; in others (Catocala, &c.), they are also placed horizontally, but somewhat expanded, and forming a triangle; in others (as Plusia), they are considerably deflexed, and the thorax is greatly crested. There is also considerable diversity in the form of the wings, though in general the anterior ones are elongate-triangular, and the posterior somewhat triangular-orbiculate: some few have the posterior margins denticulated, and the anterior wings are mostly adorned with two stigmata, one more or less circular, the other reniform, a character rarely observed in any other family in this order. The larvæ are usually solitary, not residing in a web, neither are they subcutaneous; but those of the genus Ceropacha twist up leaves similarly to those of the Tortricidæ. (*Illustrations Haustell.* 2. p. 102.)

The colours of these insects are ordinarily very sombre, agreeing with their nocturnal habits; but in some which are accustomed to fly

* Calophasia Linariæ (De G. t. pl. 8. f. 1—6.) and the Cucullidæ have the tongue case of the pupæ greatly elongated.

more by day, we find the wings, and occasionally the hind wings, more gaily ornamented. This is the case with the Catocalæ, or scarlet underwing moths; whilst the Plusiæ are adorned with patches of silver or gold. Some of the latter may occasionally be observed during the day darting about and hovering over long-tubed flowers into which they insert their long spiral tongue.

M. Dumeril (*Ann. Sci. Nat.* Sept. 1830) has published an account of two larvæ belonging to species of this family, which had been voided by a person in ill health; and in the *Bull. Soc. Nat.* Moscow, No. 5., is a notice, by M. Gomerthall, of one of these larvæ, which had been observed to be luminous. In the *Mag. Nat. Hist.* 1st ser. No. 15., is a notice, by the present Bishop of Norwich, of the occurrence of an unusual number of individuals of Noctua typicoides (Heliophobus popularis *St.*). I regret that want of space will prevent me from doing more than referring to an interesting memoir on the habits of Nonagria Typhæ, in the *Entomol. Mag.* vol. i. p. 455. (by Mr. E. Doubleday *), and in the *Ann. Soc. Ent. France*, tom. ii. p. 448. 451.; to notices of the habits of Agrotis Segetis, in ditto, 1834, App. p. 19.; Bryophila, ditto, 1836, App. p. 3., and 1837, p. 123.; to Loschge's memoir on Achatea piniperda, in *Der Naturforscher*, st. 20.; and to Mr. Wailes's memoir on Charæas graminis, in *Entomol. Mag.* No. 18. p. 232.

This family corresponds with the Linnæan section Phalæna Noctua, and comprises nearly 800 European, and 400 British species, mostly of a large or moderate size, divided by Mr. Stephens into about 80 genera, often resting upon minute structural differences. In the work of Ochsenheimer, the family comprises 42 genera, most of which correspond with the sections in the family proposed in the *Weiner Verzeichniss* (*vide antè*, p. 326.). The classification of the family is certainly a matter of great difficulty, owing to the "extreme similarity in general appearance" of the species, and which is greatly increased by the exotic species having been almost entirely neglected, although it is evident, from the figures of many species given by Drury, Cramer, Abbott and Smith, &c., that the extra-European species exhibit even greater diversity of form than those of Europe. Dr. Horsfield, we have seen (*antè*, p. 328.), proposes to divide the family into five stirpes (one of which agrees with the

* This gentleman has also published an extensive list of the species of this family captured by him, and which had been attracted by the sweets of an empty sugar hogshead.

Lithosiidæ) ; but these stirpes, being established upon the larvæ, are evidently more numerous than proposed by Dr. Horsfield. Latreille, after separating the exotic genus Erebus (in which the wings are always extended and horizontal, and the last joint of the palpi long and naked, and which comprises some of the most gigantic insects in the order), proposes to divide the remainder into two extensive and parallel series. In the first, the larvæ are geometrical in their mode of progression, some of which have 16 feet, but with the 2 or 4 anterior ventral feet shorter than the others, and the others have only 12 feet (*fig.* 108. 9. larva; 10. pupa of Plusia Gamma). The second series comprises the genera Calyptra, Xylina, Cucullia, &c., all of which have 16 feet, the anterior ventral ones being of the ordinary size, and their progression is rectigrade. Chrysoptera concha (Fischer, *Ent. Russ. Lepid.* i. iv.) in the former series, and Erastria in the latter, appear equally to lead to the Pyralides. Catocala, Ophiusa, and Brepha, on the other hand, appear most nearly allied to Erebus.

One of the chief difficulties connected with the arrangement of the order already alluded to in p. 361., is especially evident in the present family. In the Sphingidæ and Geometridæ, for instance, we find the larva state affording the best characteristics of the families; but here the case is quite different. Plusia is in effect as truly a good type of the family as Polia, Miselia, Acronycta, or Agrotis, and yet the larvæ of all these genera are strikingly distinct, some being Geometrideous, others Arctiideous, and others Noctuideous, if we consider the latter to be characterised by a naked fleshy larva, without inequalities on the surface of the body, and 16 feet. Of these, many are radicivorous, but they are easily distinguished from the Hepialideous larvæ, although the resemblance between the latter and those of Gortyna is very close. Some of these naked larvæ are external feeders, and have the body more coloured, and others have the eleventh segment of the body more or less angulated above (Miselia, Phlogophora, Trachea, &c.; *fig.* 108. 11. larva of Mamestra Persicariæ; 12. front of the head; 13. ocellar region; 14. mandible; 15. labium and maxillæ, with a thread issuing from the spinneret; 16. antenna). Acronycta varies in its larvæ, being strongly hairy in A. Menyanthidis, and having an elevated horn near the extremity of the body in some of the other species. That of Dipthera Orion nearly resembles that of an Arctia. Ophiusa has a naked larva, greatly attenuated at each

end; and Thyatira also a naked one, but furnished with a number of conical tubercles throughout the whole length of the body. Those of Catocala are strongly fimbriated at the sides of the body; in Acosmetia there are only six ventral feet (*fig.* 108. 18. larva of A. fuscula); whilst in Plusia (*fig.* 108. 9.) and Euclidia, which have semi-geometrical larvæ, there are only two pairs of ventral feet; those of the last-named genus are quite vermiform in their appearance, and having the habit of twisting themselves about in all directions (*fig.* 108. 17. larva of Euclidia Mi.). That of Erastria has only ten feet (*Hubn. Curt.*).

M. Guénée, in his memoirs upon this family, in the sixth vol. of the *Annal. Soc. Entomol. de France*, 1837, arranges the species into the eighteen following tribes:—1. Bombycoidi; 2. Pseudo-Bombycoidi; 3. Bryophagidi; 4. Nonagridi; 5. Leucanidi; 6. Noctuelidi; 7. Amphipyridi; 8. Miselidi; 9. Hadenidi; 10. Orthosidi; 11. Xylinidi; 12. Heliothidi; 13. Ctenoceridi; 14. Plusidi; 15. Catocalidi; 16. Ophiusidi; 17. Noctuoidi; 18. Noctuo-Phalænidi; in addition to which he has described another tribe, Noctuo-Bombycoidi, consisting of the genera Ceropacha, Cymatophora, Tethea, and Cosmia*, the larvæ of all of which live amongst the leaves of trees, which they fasten together with silken threads.

The tenth family, GEOMETRIDÆ† *Steph.*, is one of nearly equal extent with the Noctuidæ, from which it is distinguished by its general weakness of structure, slenderness of body, but more particularly by the remarkable peculiarities and mode of progression of the caterpillars, which has supplied the name of the family (*fig.* 109.

* *Fig.* 108. 8. represents the under side of the abdomen of a specimen of Cosmia trapetzina, in order to show the two large pencils of hairs which are at times exserted and erected, and at other times lie close upon the body, to which allusion has already been made in preceding pages. (See also Knoch, *Beitrage*, vol. iii. pl. 5. f. 6.; *Annales Soc. Ent. France*, tom. i. part. 2.; *Kirby and Spence*, vol. iv. p. 59.; and *Curtis*, 635 f. A*.)

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† BIBLIOGR. REFER. TO THE GEOMETRIDÆ.

Audouin. Obs. sur une Chenille du g. Dosithea, in Ann. Soc. Ent. France, 1834.
Eversmann, in Bulletin Soc. Nat. Moscow, 1837.
Rambur, in Ann. Soc. Ent. de France, tom. i. part 3., and tom. ii.; and the general works on Lepidoptera above referred to.

Fig. 109.

3. Abraxas grossulariata). The head is of moderate size; the maxillæ short and weak, being nearly membranous; the labial palpi small and cylindrical; the antennæ variable, being strongly bipectinated in some males (*fig.* 109. 6. antenna of Himera pennaria ♂; 4. head of Ourapteryx sambucaria ♂; 5. part of its antenna; 7. joint of antenna of Hybernia defoliaria ♂). The wings are of large size, and various outlines, and are often extended horizontally (in a few species they are occasionally carried vertically). The thorax is never crested. The legs are slender, the anterior tibiæ being armed internally with a spur (*fig.* 109. 8.), and the posterior with two pairs of those appendages.

The caterpillars are called loopers, or geometricians, from the peculiar mode of their progression. They have only three pairs of pectoral, and one (the hindmost) pair of ventral prolegs, with a pair of anal feet; and hence, in walking, they first fix themselves firmly, by means of their anal and ventral feet; they then extend the body to its greatest length, when they put down their fore feet, drawing the hind part of the body as close after them as possible, so as to form an arch, like a pair of compasses, fixing their hind feet, and proceeding again as before. Their muscular power is very great, and hence their positions during repose are very striking. Fixing themselves by their anal feet alone, they extend their bodies in a straight line, holding it in that position for a great length of time. This, together with their obscure colours, and the warts which their body exhibits, renders it often quite difficult to distinguish them from twigs of the trees on which they feed (*fig.* 109. 11. young larva of Ourapteryx sambucaria in its stationary attitude; 10. ditto just hatched, showing them in various positions; 1. geometrical position

of the larva of Abraxas grossulariata; 2. pupa of ditto; 12. the larva of the Lilac Beauty, Pericallia syringaria, distinguished from all the other caterpillars in the family by the recurved horns upon the eighth segment of the body). Mr. Stephens describes the larvæ of some of the genera as possessing 12, and others 14 feet.*

If we except Campæa Margaritata (the larva of which has lateral appendages at the sides of the middle segments of the body, giving it the appearance of a greater number of prolegs than it really possesses), and the Cerura-like larvæ of Platypteryx (*fig.* 109. 13.), the figures given above represent the most marked variations in the appearance of the larvæ of this family, except such as have 12 or 14 feet, as already mentioned.

These caterpillars feed upon the leaves of various trees and plants, and have the instinct, when alarmed, of dropping down from the leaves, and suspending themselves by a thread, which enables them to remount when the danger is past. The chrysalides are either naked and suspended by the tail, or enclosed in a very slender cocoon, which is rarely subterranean, and oft-times placed amongst dry leaves, &c.

In the perfect state, these insects offer very little variation in their habits, flying sluggishly in the twilight, or when disturbed during the day, and quickly settling again amongst the foliage of woods and hedges. In their colours, they are much more beautifully ornamented than the Noctuidæ; and many species have a broad wavy band across the fore wings, whence they have obtained the name of carpet moths: they rarely exceed a moderate size. In some species, the females are almost, or entirely, destitute of wings (*fig.* 109. 9. Hibernia defoliaria ♀). Some of these, as the Cheimatobia brumata, are exceedingly injurious to fruit trees, devouring the tender shoots and leaves in the spring (see Kollar's work on Noxious Insects); whilst Bupalus piniarius is occasionally exceedingly destructive in the pine forests of Germany. (Silbermann, *Rev. Entomol.* No. 9.)

The males of one small group (genus Lobophora *Curtis*) are singularly distinguished by their hind wings being furnished with a small membranous lobe, giving them the appearance of possessing an extra pair of wings.

M. Duponchel has described a singular Gynandromorphous individual of Angerona prunaria (in *Ann. Soc. Ent. de France*, 1835, pl.

* In the species figured by De Geer (*Mém.*, tom. i. pl. 25. f. 1—7.), the larva has three pairs of ventral feet, the first and second of which are very minute.

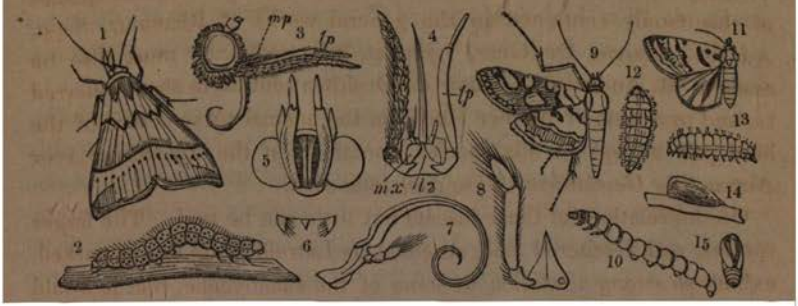
1. f. 5.). In addition to the numerous memoirs upon various species of this family contained in the general works of Réaumur, Sepp, Admiral, Harris, De Geer, Lyonnet, &c., reference must also be made to M. Audouin's Memoir on Dosithea scutularia above referred to, and to a memoir by Ver Huell, on the anomalous structure of the hind pair of legs in this species, contained in the *Tijdschrift voor Natuurlijke Geschiedenis*, 11se deel. 3de stuk.

Of the relations of these insects but little can be said. The larger species, with feathered male antennæ, as Latreille long ago remarked, exhibit so strong a relation to some of the Bombycidæ, that it would be rash, looking at the imagines alone, to assert that the relation was not one of affinity. On the other hand, we have seen them nearly related to the Noctuidæ. Mr. Curtis proposes to divide these insects into two families, characterised by the structure of the male antennæ; but such a step would unnaturally break many strong relations, as pointed out by Mr. Stephens. (*Illustr.* iii. p. 143.) Platypteryx* (*fig.* 109. 14. Pl. falcataria) constitutes a most anomalous group, which, in the imago state, seems to be one of the types of form of this family; but its larvæ (*fig.* 109. 13. larva of Pl. lacertula) are altogether distinct, and more nearly resemble those of Cerura; but this relation is so slight, that Latreille has evidently confounded a relation of analogy with one of affinity in uniting them into one tribe, Aposura.

The eleventh family, PYRALIDÆ, is one of moderate extent, and the species are of a small size, having the body slender and elongated; the antennæ simple, or but slightly ciliated in the males; the labrum and mandibles small (*fig.* 110. 6. these parts in Crambus (Lyndia) Cannarum *Sav. Egypt*); the labial palpi (*fig.* 110. 8. labium of the same) often greatly elongated and porrected, but occasionally recurved, with the maxillary ones occasionally developed (*fig.* 110. 3. m. p.; *fig.* 110. 4;—5. and 7. head and maxillæ of Cr. Cannarum); the maxillæ themselves are generally of moderate length (*fig.* 110. 7.), although in Hydrocampa very small, and in Aglossa nearly obsolete; the head (*fig.* 110. 3. head of Botys (Ismene) pelusia *Sav. Egypt.* sideways; 4. maxillæ, labium, and labial palpi of the same) is occa-

* See Laspeyres, Verschl. zu g. Platypteryx, 4to. Berlin, 180?; and in Der Gesellsch. Naturf. Freund zu Berlin, n. Schrift, 4 vol.; and Lyonnet's Posth. Recherch.

Fig. 110.



sionally furnished with a pair of ocelli; the thorax is of moderate size, never crested; the wings are also of moderate size, and generally placed in a triangle during repose (whence Latreille's name of Deltoides given to the section composed of the typical group *fig.* 110. 1. Hypena proboscidalis); the anterior wings are generally slightly angulated at the tip; the legs are ordinarily very long, especially the fore pair, of which the coxæ are nearly as long as the tibiæ (as in Hydrocampa Potamogata, *fig.* 110. 9.), thus indicating the great activity of movement which these insects so frequently exhibit. In some species the fore legs of the males are singularly ornamented with fascicles of hairs capable of expansion, whence the species have received the name of fan-footed moths*; the anterior tarsi of the males of some of the species of Pyralis are obsolete. There is a considerable diversity, however, not only in the perfect insects, of which this family is composed, but also in the preparatory states; in general, the caterpillars are long and slightly hairy (*fig.* 110. 2.; larva of Hypena proboscidalis). They vary in the number of legs, having mostly only three, but sometimes four pairs of ventral feet (*fig.* 110. 11. larva of Hydrocampa lemnalis). They are never geometrical in their motion, nor radicivorous in their habits, nor are their bodies densely clothed with hairs; in all which respects they vary from the preceding and following groups; but it is to be admitted, that the limits of the family are not clearly defined; for instance, Latreille confines it to his genus Herminia, composed of the strongly rostrated species (Crambus barbatus, rostratus, &c.), whilst Stephens considerably increases its extent, and adds to it the genera Nola, Simaëthis, and some other anomalous genera, forming Latreille's first section of

* As also in the Indian typical Hyblææ *Fabr.* See Esper, Monogr. on this g. in Der Naturforscher, st. 29.

Tineites in the *Règne Animal.* The family is here made to comprise Linnæus's 12 or 14 last species of Geometræ, and the whole of his Pyralides, which he characterised "alis connivèntibus in figuram deltoideam forcipatam." (*Syst. Nat.* vol. ii. p. 809.)

Of these species those which compose the genus Hypena and its allies are the largest in the family, and have the labial palpi greatly elongated; the species are found in hedges, and amongst low herbage, and the larvæ are well distinguished by having only three pairs of ventral feet; the chrysalis is enclosed in a slight cocoon in a leaf rolled up by the larva. (Lyonnet has figured the transformations of several of the species P. pinguinalis *Linn.*, &c.) The species of Aglossa, on the other hand, are domestic insects, being found in houses, their larvæ feeding upon butter, grease, and other similar substances *; whilst that of Pyralis farinalis *Linn.* feeds upon meal, flour, &c. The species of Pyrausta *Schr.*, Pyr. purpuralis *Linn.*, &c., are gaily coloured insects, which frequent hedges, and revel in the sunshine, hovering over grassy spots, but immediately settling as soon as the sun is overclouded; whilst those of Hydrocampa and its allies frequent aquatic plants, upon which the larvæ feed, inhabiting moveable cases, formed of portions of the plants; the sides of the body of the larvæ in some species which reside beneath the surface of the water being furnished with elongated filaments (as in some of the Phryganeidæ), employed in extracting the oxygen from the water. (See De Geer, tom. i. pl. 37.; and the *Physiological Researches* of Dutrochet read before the Académie des Sciences upon the subject of these aquatic larvæ.) Réaumur (tom. ii. pl. 32.) and Lyonnet have described the transformations of other species, the larvæ of which appear to be destitute of these appendages.

I possess some very singular exotic species belonging to this family from North America, one of which has the antennæ of the males elbowed and thickened in the middle (Desmia maculalis *Westw.*, in Guér. *Mag. Zool.* pl. 2.). Another species, apparently allied to Hydrocampa, with the labial palpi of the males as long as the body, the basal joint porrected, and the two others thrown over the back, has been figured by Poey (*Cent. Lepid. Cuba*, pl. 8.) under the name of Mastigophorus Parra; the same author has also figured the transformations of Pyralis hyalinata *Linn.*, a species remarkable

* Linnæus adds, "In ventriculo humano larva pessima expellenda infuso lichenis cumatilis." (*Faun. Suec.* p. 351.) Other instances of larvæ inhabiting, accidentally, the human intestines, have been already noticed in this work.

for its tasselled tail, in the same work (pl. 19.); the larva has 16 feet, and the pupa is enclosed in a very loose cocoon. This species is the type of Guilding's manuscript genus Phakellura. The genus Nola appears nearly allied to the Tortricidæ, not only in the elevated patches of scales in the wings (*fig.* 110. 11. N. cucullatella), but also in the habit of its cocoon (*fig.* 110. 13.); its larva (*fig.* 110. 12, 13.) is naked and depressed, pilose, and furnished with 14 feet. Odontia dentalis has a smooth larva, slightly tapering at both extremities, with 6 pectoral, 8 abdominal, and 2 anal feet, and which forms a close cocoon amongst leaves, obtuse at one end, and pointed at the other (*Hubner; Curtis*, 563.). Simaëthis is another genus, which in its form seems also allied to the Tortricidæ, but its transformations are not known; they fly during the day, even at noon, and settle on leaves exposed to the sun, their motions being very curious; several, which I have watched, moving sideways, and in a circular direction; and when they had completed the circle, they returned in the opposite direction, so as to complete the circle the contrary way. Kirby and Spence notice a similar motion in their *Introduction*, vol. ii. p. 369.

The twelfth family, TORTRICIDÆ*, or the section Tordeuses of Latreille, Platyomides of Duponchel, or Pyralides of other French writers, is a group of considerable extent, composed of minute, generally dull-coloured moths, distinguished by their broad entire fore wings, which form a triangle with the body when at rest, slightly deflexed at the sides, and dilated towards the shoulders (*fig.* 111. 8. wing of Carpocapsa Pomonella). The maxillary palpi are never prominent, although possessed by many species, but being in them very minute; the labial palpi, on the other hand, are broad and very compressed,

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* BIBLIOGR. REFER. TO THE TORTRICIDÆ.

Froehlich. Enumer. Tortricum Wurtembergiæ. 8vo. Tubing. 1828.

Fischer Ed'er von Röslerstam. Abbild., &c., der Mikrolepidopterologie. 4to. Leipzig, 1833; in parts.

Duponchel. Divis. de la Tribu des Platyomides, in Annal. Soc. Ent. de France, 1834.

And the general works of *Linnæus, Fabricius, Stephens, Haworth, Wood, Curtis, Donovan, Treitschke, Hubner, &c.*

Fig. 111.

especially the middle joint, which is curved above, the last joint being short, and often more distinct and exposed: they are never recurved, but generally form a short beak in front of the head (*fig.* 111. 16. head of Cochylis rupicola *Curtis;* 17. labial palpus of the same); the spiral tongue is short in the majority. The body is slender; the thorax rarely crested; the antennæ simple, or slightly ciliated in a few species (*fig.* 111. 5. part of antenna of Hylophila quercana; 18. ditto of Cochylis rupicola). The fore legs, in the majority, have a central tibial spur (*fig.* 111. 13.), the intermediate tibiæ one pair of terminal spurs (*fig.* 111. 14.), and the hind tibiæ a pair at the middle, and another at the tip (*fig.* 111. 15.). The wings in some species (Peronea, Sarrothripus, &c.) are ornamented with small tufts of scales; and those of the genus Peras of Treitschke are deeply notched in the fore margin. The larvæ are naked fleshy grubs, with 6 pectoral, 8 ventral, and 2 anal feet, which, for the most part, take up their abode in a leaf, curled up by the insect itself, and fastened with silken threads, forming a cylindrical tube, open at each end, which thus serves them for abode and food (De Geer, *Mém.* tom. i. pl. 27.; and Réaumur); others frequent the young buds and shoots of various plants, fastening several of the leaves together so firmly as to impede its growth. Others, again, reside within the pulpy substance of various fruits, especially the apple and plum, to which they are occasionally very detrimental.

This family offers a striking instance, proving that the largest and most conspicuous insects in a group are not to be considered as necessarily constituting its pre-eminent types. Here we find the Tortrix prasinana *Linn.* (*fig.* 111. 1.— Hylophila pr. *Hb.*) to be the largest species; but, if we examine its characters (in any of its

states), we find it remarkably aberrant from the great majority of the family. The head (*fig.* 111. 6.) is seen to be furnished with an elongated spiral tongue; the labial palpi are slender (*fig.* 111. 7.); the caterpillars are naked, and more slender at the tail,—hence named by Réaumur "chenilles en forme de poisson" (*fig.* 111. 2.); the cocoon (*fig.* 111. 3.) is in the shape of a boat turned upside down, attached to a leaf; and the chrysalis is not furnished with abdominal rows of spines. Several allied species correspond in these habits. My figure 111. 9—15. represents the history and details of a pretty species (Argyrotoza Bergmanniana), which commits great havoc in our gardens, by eating the young buds and leaves of the roses; the caterpillar (*fig.* 111. 10.) feeding within the bud, from which, when disturbed, it lets itself down by a thread: others tie several of the young leaves together, consuming the inner layers, and changing to pupæ without forming any cocoon; the chrysalis, when ready to assume the perfect state, pushing itself half out of the end of the perfect leaf (as at *fig.* 111. 11.), by the assistance of the transverse series of short recurved spines, two rows of which are placed upon each segment of the abdomen (*fig.* 111. 12. pupa magnified; 9, the imago; and 13, 14, 15. its tibiæ above described. Westwood, in *Gard. Mag.* No. 90. Sept. 1837.)

Another insect of the same family, Carpocapsa Pomonella, the codling moth, is one of the most destructive enemies to the apple crops in this country, laying its eggs in the eyes of the newly-formed fruit, within which the larva feeds, its presence being only indicated by the premature falling of the fruit. I have detailed the history of this insect in my series of articles on the insects most injurious to cultivators in Loudon's *Gard. Mag.* May, 1838, No. 98. In the same work (No. 94. January, 1838), I also published the history of Ditula angustiorana, the larva of which does great damage to our apricot trees in the early spring, by tying the young shoots together with threads so firmly, that their growth is stopped, and by devouring the young blossom-buds.

Another species, Tortrix viridana, feeds upon the oak, which, in certain years, it totally strips of its foliage, its numbers being so great, that when the branches of that tree are sharply beaten, a complete shower of these moths is dislodged. Other species, as Carpocapsa Wœberana, live upon the wood, or beneath the bark of plum trees; whilst some, as Orthotænia Turionella, and Resinella,

feed on the young shoots of the Scotch fir, which they perforate. (De Geer, *Mém.* tom. i. pl. 33.) One of the most destructive insects in the family is the Tortrix vitana *Bosc* (Pillerana *Fab.*), a species which, in the larva state, attacks the leaves of the vines in France, rolling them up and fastening them together with threads. Its history has lately attracted considerable attention, having been investigated, with a view to its destruction, by Messrs. Audouin (*Annal. Scienc. Nat.* 1838, two memoirs), Guérin (in *Dictionn. Pittoresq. d'Hist. Nat.* art. *Pyralis*), Walckenaer (in *Annal. Soc. Ent. de France*, mém. *Ins. nuisibles à la vigne*), and others.

M. Duponchel has published a distribution of these insects (above referred to), in which he divides them into nine groups, according to the habits of the larvæ, and the mode in which they attack plants. As, however, out of 300 Europæan species, not more than one-sixth have been observed in the larva states, it is most probable that this arrangement will require modification when the others have been equally investigated.

The thirteenth family, YPONOMEUTIDÆ*, comprises an extensive collection of minute moths, distinguished from the Tortricidæ by

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* BIBLIOGR. REFER. TO THE YPONOMEUTIDÆ AND TINEIDÆ.

Réaumur. Hist. des Teignes, ou des insectes qui rongent les laines, in Mém. Acad. Paris, 1728.

Goeze, in Der Naturforscher, st. 4, 5. and 14. (on Mining Caterpillars).

Zincken Sommer. Die Linneischen Tineen in Gattung. in Germar's Mag. d. Ent. vol. ii. pt. 3. and 4. (on Chilo and Galleria.) — Ditto (with Charpentier), Die Zünsler, Wicklet, Schaben, und Geitschen des Wien. Verzeichn. 8vo. Brunswick, 1821.

Hummell, in Essais Entomol. No. 3. on Tinea bisselliella (La Teigne des Meubles).

Sadoffsky. Lepid. Micropter. Sp. Nov. in Bull. Soc. Mosc., 1829.

Esper, in Der Naturforscher, st. 25. (Ein. kl. prachtigste Schmett.)

Bosc, in Trans. Linn. Soc. vol. i. on two Tineæ.

Laspeyres. On Tinea sociella and colonella, &c., in Berlin Mag. 2., 1808.

Dahlbom, in Swedish Trans., 1835. Ypsolophus Falleniellus and Yponomeuta Padella.

Bernatowitz. Mémoire sur la Chenille qui fait des ouates, Bibl. Univ. Génève. Feb. 1825.

Nenning. Ueber Tinea Uvæ. Constanz, 1811, 1 pl. 8vo.

Boyer de Fonscolombe. On Tinea oleella and olivella, in Ann. Soc. France, tom. vi.

Fig. 112.

having the labial palpi long and slender; and from the Tineidæ, in having the maxillary palpi rarely, and then but slightly, developed * (*fig.* 112. 1. Yponomeuta padella). The body is ordinarily slender and elongated, but rather depressed, in a few groups most nearly allied to the Tortricidæ; the head (*fig.* 112. 2. head of Yponomeuta; 8. head of Œcophora; 9. head of Metallosetia spissicornis) is small, and occasionally clothed with long scales in front; the antennæ long, slender, and generally simple in both sexes; the thorax is rarely crested; the wings are entire (*fig.* 113. 9. fore wing of Depressaria), and often long, narrow, and more or less convoluted, the posterior having very long ciliæ; the legs are of moderate length, and spurred as in the majority of moths; the anterior tibiæ having one (*fig.* 112. 3.), the intermediate two (*fig.* 112. 4.), and the posterior four spurs (*fig.* 112. 5.); the palpi are generally long and slender, and mostly recurved, but drooping in a few species, with the terminal joint distinct from the preceding, and not so thickly clothed with

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Duponchel. On Tinea decuriella, in Ann. Soc. Ent. de France, No. 3. — Ditto, in ditto, 1838. General revision of the Tineidæ.
Desjardins. On Plutella Xylostella, in ditto, vol. vi.
Fauna del Regno Napoli (Monograph on Œcophora).
Curtis. On Cecidoses, in Trans. Zool. Soc. vol. i. pl. 40.
Bohemann, in Swed. Transact., 1837 (Tinea Linneella).
Fischer von Röslerstam. Abbild. zur Bericht. der Mikrolepidopterologie.
And the general works above referred to.

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* "Les Yponomeutes, une ou deux exceptés, les Œcophores et les Adèles, sont presque les seules Tinéites, dont les palpes supérieures ou maxillaires ne soient pas bien apparents." (Latreille, *Règne An.* tom. v. p. 417.)

scales. Mr. Stephens, to whom we are indebted for the establishment of this family, observes, that there is considerable diversity of habit amongst these insects, some of them residing in the larva state on flowers, upon which they subsist: others are found within the surfaces of leaves, devouring only the parenchyma; some form extensive webs, and live in society; others are solitary. Amongst the subcutaneous species are some of the most brilliant of the Lepidoptera, their wings being ornamented with highly polished metallic scales, and some of them being extremely varied in the number of their tints; others, again, are very plain; the former set have generally drooping palpi; the latter ascending recurved ones. (*Illust. Haustell.* vol. iv. p. 196.)

The typical insects of this family, forming Latreille's genus Yponomeuta, are amongst the largest in the family, having the fore wings long, and convoluted when at rest, and the posterior large, and with moderate ciliæ. They are generally of white or slate colours with black spots, whence their names of small ermine moths; the larvæ (*fig.* 112. 6.) reside in large societies under a common web on various fruit trees, and especially on whitethorn hedges, which are sometimes entirely defoliated by them. I have also seen the apple trees, along the sides of the roads in France, equally deprived of their leaves by these insects, and festoons of their webs suspended from the tree, and clothing the surface of the ground beneath the trees. These larvæ are of a slate colour with black dots, and let themselves down to the ground when alarmed. They have six pectoral, eight ventral, and two anal feet. They form their cocoons in company together, in the midst of their webs (Westwood, in *Gard. Mag.* Oct. 1837; and Dahlbom, in *Swed. Trans.* 1835). Mr. Lewis (*Trans. Ent. Soc.* vol. i. p. 22.) has published an account of the habits of this insect, in order to account for the sudden appearance of the "blight," as the young brood of larvæ are termed. M. Habenstreit of Munich, by compelling these caterpillars to spin their webs on paper, has been enabled to obtain a sufficient quantity of silk to manufacture into various articles. (*Literary Gazette*, Nov. 1826.) M. Lenormand also presented a memoir on this subject to the "Academie," which was reported on by Latreille and Bosc, on 27th Nov. 1826. Other species, referred to this genus by most authors, are solitary in the larva state.

The species of the genus Depressaria *Haw.* are distinguished, as the name implies, by their flat broad body and horizontally carried

wings, but their palpi are recurved; they feed in the larva state on umbelliferæ, and pass the pupa state in the stalks of these plants. De Geer's figures (tom. i. pl. 29. f. 1—8.) represent the transformations of one of these insects. The figures 9—18., on the same plate, apparently represent the transformations of a singular species, Lophonotus fasciculellus *Steph.*, which has the inner margin of the fore wings adorned with several bundles of prominent scales. This insect has very narrow, deeply-fringed wings, as has also the species of the genus Anacampsis, one of which, separated by Curtis, under the generic name of Laverna (Ph. Tinea sarcitella *Linn.*), is extremely injurious in houses, the caterpillar feeding upon woollen articles and clothing, of which it forms for itself a moveable case, and within which it changes to a chrysalis.

The elegant species of Œcophora (*fig.* 112. 7. Œc. sulphurella ♂) fly during the day, frequenting gardens and hedges: I have reared the species figured from larvæ found under the bark of felled fruit trees. Adela also comprises day-flying species, known under the name of Japan moths, or long-horns; the former name alluding to their polished metallic wings, and the latter to the great length of the antennæ. They frequent woods, and fly in troops, like gnats, over the bushes in the sunshine (*fig.* 112. 10. Adela De Geerella ♂). The transformations of this interesting genus have been observed by Lyonnet (*Recherches*, pl. 19.); the larva of A. De Geerella (*fig.* 112. 12.) inhabiting a flattened case, formed of bits of leaves (*fig.* 112. 11.); and its pupa being very remarkable, in having the greatly elongated antennæ coiled up in a roll at the extremity of the abdomen (*fig.* 112. 13.).

The larvæ of several other of the genera inhabit cases formed of various materials, which they bear about with them. One of the most singular of these cases is that figured by Réaumur (*Mém.* 3. pl. 26. f. 6.; and my *fig.* 112. 21.), which has been referred to Tinea palliotella. I have succeeded in rearing the perfect insect, which has the fore wings entirely white (Porrectaria —— ?). Another curious case has been communicated to me by the Senator Van Heyden (*fig.* 112. 22.), who reared Tinea Vibicipenella *Tr.* from them, as well as numerous specimens of my parasitic genus Elasmus. (See also Kuhn, in *Der Naturforscher*, st. 7. tab. 3.; st. 9.; and Scheven, in ditto, st. 11.) Some of these case-making species, as the Cochleophasia tessellea, have apterous, or nearly apterous females, which is also the case in Dasystoma,

Chimophila, and Diurnea. The caterpillars of the last-named genus are described by Gödart as flat, furnished with two rows of verrucose dots, each terminated by a little hair, armed with a corneous shield on the back, with the third pair of pectoral feet in form of a battle-door, living and metamorphosing between the leaves; in walking they spread their pallet-shaped feet very much, and, when disturbed, make a noise with them, which faintly resembles the rolling of a drum, according to Treitschke, as quoted by Curtis.

But the most beautiful species in the family are those minute moths with metallic spotted wings, the majority of which, in the larva state, are leaf-miners; such are the genera Microsetia, Glyphypteryx, Pancalea, and Argyromyges. My *fig.* 112. 16. represents a portion of a rose leaf mined by Microsetia ruficapitella*, the larva of which is extremely interesting, offering, as far as I can perceive, no rudiments of legs, except fleshy angular projections of the skin of very small size; and the head is capable of being almost entirely withdrawn into the prothorax. De Geer has given the history of this insect (*Mém.* pl. 31. f. 13—21. and 30. fig. 20.), and has represented the fleshy leg-like tubercles (as in *fig.* 112. 17.) of a much larger size than I saw them, and eighteen in number, placed on consecutive segments. My *figure* 112. 18. and 19. represents the upper and under side of the larva, and 20. the pupa of Argyromyges Cramerella, which I have reared from mined oak leaves: here the larva has three pairs of membranous ventral feet. De Geer has figured the history of this and another allied species in his *Mémoires*, tom. i. pl. 30. and 31. (See also Swammerdam, *Book of Nature*, pl. 44. f. 18—21.) Mr. Curtis has figured the history of Arg. autumnella, the larva of which appears to have been naked, and the cocoon ingeniously suspended by threads from each end like a hammock (*Brit. Ent.* pl. 284.). There is an interesting memoir upon a species with similar habits in the *Trans. Soc. Geneva*, 1837. The history of a minute, but highly interesting species, with white wings, varied with brown spots, is given by De Geer, tom. i. p. 468. pl. 32. f. 1—, the cocoon of which is long, semioval, and ribbed; the construction of which, by crossing the threads in a remarkable manner, has formed the last subject of De Geer's fourteenth Mémoire, as well as of one by Lyonnet (*Recherches*, pl. 19.).† De

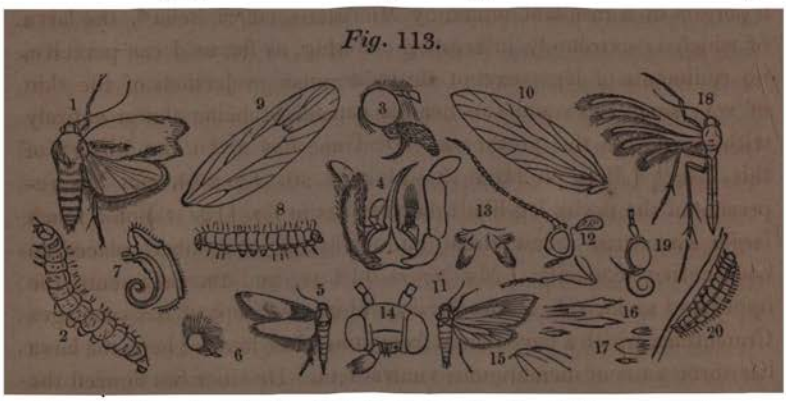
* Lewis (in *Entomol. Mag.* vol. i. p. 423.) has published a memoir on this species.

† Lyonnet has also published the details of the history of some other species with somewhat similar cocoons. (*Recherches*, pl. 33.)

Haan gives this as Tinea sequella, but a specimen of the cocoon, which I found near Berlin, was named for me by the Senator Van Heyden, Tinea rhamnifoliella.

The fourteenth family, TINEIDÆ, comprises an extensive series of minute Lepidopterous insects, distinguished from the Tortricidæ by their narrower wings, as well as by the slenderness of their palpi; whilst the great development of the maxillary palpi, and the rare occurrence of recurved labial palpi, separates them (but by no means satisfactorily) from the Yponomeutidæ. The body is generally long and slender (*fig.* 113. 5. Tinea tapetzella); the head often densely

Fig. 113.



clothed with scales in front (*fig.* 113. 6. head of Tinea granella; 3. head of Galleria cereana); the antennæ of moderate length, slender, and generally simple in both sexes, or pubescent beneath in the males; the spiral tongue, or maxillæ, is short (*fig.* 113. 4. maxillæ and labium of Galleria cereana *Savigny*); but the maxillary palpi are well developed, although occasionally short, yet forming a pair of scaly projections, distinct from the labial palpi; in some, however, they are extraordinarily elongated, as shown in the dissections of various genera, published by Mr. Curtis (*fig.* 113. 7. maxilla of Tinea granella), and composed of five or six joints; in the majority, however, they are shorter, thickened at the tips, and 3-jointed; the thorax is rarely crested; the legs spurred in the ordinary manner; the wings are entire, often very narrow, and mostly convoluted in repose; the posterior are of moderate size, and are much folded when at rest.

In their preparatory states, these insects are variable in their

habits*; but their larvæ are generally naked or slightly hairy; many residing in portable cases formed of various materials, in which they undergo their transformations, whilst others feed upon vegetable substances; some residing within the stalks of plants, and others upon their leaves; a few being subcutaneous.

In their perfect state, they are mostly of a larger size than the minute gilt species, belonging to the preceding family; and in their colouring they rarely exhibit any of that brilliancy of gold and silver with which so many of the latter are ornamented; their usual tints being, as Mr. Stephens observes, of a rather sombre hue, in which ochre, white, or buff colour, with longitudinal marks or streaks, in varied irregular characters, are conspicuous; the posterior wings being generally plainer. We know nothing of the exotic species of this and the preceding families, nor of their transformations. Our arrangements must therefore as yet be considered as unsettled.

The typical species of this family compose the genus Tinea, whose history is so well sketched by Pliny in these words: "Est item Tinea quædam pendula, vel tunicata, tunicam suam sensim attrahens, ut cochleæ testam; quâ spoliata statim expirat: si vero nimium excreverit tunica, in chrysalidem abit, ex quâ Phalæna quædam exigua (*fig.* 113. 5. Tinea tapetzella) stato tempore erumpit" (*Mouffet*, p. 274.); and which have afforded the beautiful image of a "moth fretting a garment," so often alluded to in holy writ. It is, of course, in the larva state that these insects are so destructive to woollen materials of every description, feathers, furs, skins, and objects of natural history, upon which they feed; using the material also for the construction of their moveable cases; in which, when full grown, they change to chrysalides, which protrude themselves out of the upper extremity of the case, head foremost; the larva having had the instinct to turn in its case previous to pupation. These larvæ have six pectoral, eight ventral, and two anal feet. There are fifteen British species of this genus, including some (T. granella, or the wolf, *Philos. Transact.* 1694, and *Trans. Philadelph. Soc.* vol. i. 1789) which commit great havoc in granaries and in malt-houses, feeding upon the grain, and fastening it together with silken threads.

The species included in the genus Galleria *Fabr.* inhabit the nests

* M. Duponchel has divided these insects into sixteen classes, according to the variations in the habits of their preparatory states. I regret that I can only refer to his interesting memoir (*Annal. Soc. Ent. de France*, 1838, p. 127.).

of bees, the larva feeding upon honey, and forming galleries in the honeycomb. Two species, G. alvearia *Fabr.* and G. cereana (*fig.* 113. 1. ♂) *Linn.* (mellonella *Linn.*), reside in the common hive, and occasionally in such vast numbers as completely to destroy it, enveloping the comb and many of the bees in the webs spun by the larvæ (*fig.* 113. 2., larva of Galleria cereana). The species of Ilythia also feed upon the honey collected by Bombi, and occasionally in numerous colonies, whence the specific names Sociella and Colonella, applied by Linnæus to the sexes of the typical species; I have described a singular nest, or rather mass of the cocoons of this insect, communicated to me by Mr. Loudon, in the *Mag. Nat. Hist.* vol. ix. p. 528.

The species of Crambus (*fig.* 112. 14. Crambus pinetorum) are extremely numerous, and are distinguished by their porrected palpi (*fig.* 112. 15. head of Cr. margaritellus); their wings are much convoluted when at rest, whence their name of "*Close-wings*," and they generally abound in grassy places, settling upon the stalks head downwards. Chilo is allied to these insects, but the palpi are much longer, and the larvæ live in the stems of reeds (being naked, with the head and prothorax horny and polished, with six pectoral, eight ventral, and two anal feet); the moths being found in boggy and marshy places.

The Rev. L. Guilding described an insect belonging to this family under the name of Diatræa Sacchari (in a memoir published in the *Trans. Soc. Arts*, vol. xlvi. p. 143., for which he received the gold Ceres medal), being by far the most destructive enemy of the cane, which is never exempt from this dreaded pest, which occasionally, in some of the West-Indian Islands, destroys whole acres, the larva burrowing into the centre of the stems. This insect is, however, evidently identical with the Phalæna saccharalis *Fabr.* (*Ent. Syst.* vol. iii. part 2. p. 238.), which is described thus: — "habitat in Americæ Meridionalis saccharo, cujus caules perforat, destruit, exsiccat, plantationum pestis."

Harpipteryx, as the name implies, comprises species having hook-tipped wings; the larva of H. dentella feeds upon the honeysuckle, and is described as fusiform, smooth green, with a purple dorsal line, and the chrysalis is enclosed in a fusiform cocoon, open at each end. The cocoon of another species, observed by myself at Hammersmith, is composed of beautiful open lacework, permitting the pupa enclosed

to be seen. De Geer figures the history of this or a closely allied species (*Mémoires*, tom. i. pl. 26.).

The species of Euplocamus are the largest in the family, their larvæ agreeing in structure with those of Chilo; but the antennæ of the males are more or less strongly fasciculated, especially in the reputed British species Eupl. Anthracinellus; the typical species of Incurvaria *Haw.* (I. masculella) has also the antennæ of the males strongly pectinated. The species of Gracillaria *Haw.* are distinguished by the length of the antennæ, narrowness of the wings, and great breadth of the ciliæ of the hind wings. The moths sit in a very peculiar manner, with the head greatly elevated, the hind pair of legs concealed, and the two anterior pairs extended nearly at right angles from the body, the fore leg on each side being hidden by the middle leg, which is densely clothed with scales; the larva (*fig.* 113. 8.) of G. anastomosis *Haw.* (syringella *Fabr.*?) feeds upon the leaves of the common lilac, which it at first mines, and when grown sufficiently strong, it rolls up the ends of the leaves into a coil, in which it resides. It is very common, and has afforded me the means of studying its history as well as that of its Ichneumonideous parasites. The late E. W. Lewis also investigated the history of this species, and observed, that Pimpla stercorator punctures the roll of the leaf in order to dislodge the caterpillars on which it feeds. (*Mag. Nat. Hist.* vol. vi. p. 414.)

It is in this family that I would, *provisionally*, place the genera Lampronia and Eriocephala, distinguished by their metallic colouring, the latter of which, in the great length of its maxillary, and the minuteness of its labial palpi, noticed by Mr. Haliday, as well as in the nervures of its wings (*fig.* 113. 10.), offers so great an exception to the remainder of the order, and approximates so closely to some of the Trichoptera. (See *antè*, p. 324. note.) It is to be regretted, that the transformations of this and other equally anomalous groups have not been observed with sufficient precision. Delta (*Ent. Mag.* vol. i. p. 389.), however, describes the larva of Lampronia capitella as somewhat resembling that of Cossus ligniperda, and as burrowing into the young shoots of the currant.

It is in this order, without hesitation, and provisionally also in this family, that I include the genus Acentropus, which Mr. Curtis regards as Trichopterous, and which Mr. Stephens at first placed amongst the Neuroptera, and subsequently amongst the Trichoptera.

I have already (p. 324.) stated the grounds for my opinion as to its location amongst the Lepidoptera. My *fig.* 113. 11. represents Acentropus Garnonsii; 12. the head and prothorax seen sideways, showing the tippet; 13. the palpi, having a minute lateral pair of appendages, which I regard as the other pair of palpi; 14. the front of the head, distinctly exhibiting a pair of maxillæ; 15. the base of the hind wing, showing the spring or bridle; 16. scales of the apex of the wing; and 17. scales of the disk of the wing.

Mr. Curtis has described a Lepidopterous insect, supposed by him to belong to this family, under the name of Cecidoses Eremita (*Trans. Zool. Soc.* vol. i. pl. 40.), the pupa of which inhabits a gall found on a Brazilian shrub. Réaumur has also described a similar gall and insect from Cyprus (*Mém.* tom. iii. pl. 39. f. 1—4.), but Mr. Mac Leay assures me that the supposed galls are in fact the cocoons formed by these insects.

The fifteenth and last family, ALUCITIDÆ, or the Fissipennes of Latreille, is nearly allied to the preceding family, both in respect to the elongated form of the body and narrowness of the wings; but the latter, except in one genus, are singularly cleft into narrow feathered rays (*fig.* 113. 18. Pterophorus pentadactylus); the fore wings having two, three, four, or six, and the posterior wings three or six of such rays, which are beautifully feathered on each edge; they are carried horizontally in repose; the antennæ are long, slender, and setaceous; the labial palpi vary considerably in length, being somewhat recurved in Alucita, and still less so, as well as much shorter, in Pterophorus. The spiral maxillæ are long, and the maxillary palpi are not evident; in which respects these insects approach the Yponomeutidæ (*fig.* 113. 19. head of Pterophorus). The legs are long and slender; the fore tibiæ with one, the intermediate with two apical, and the posterior with two apical and two subcentral spurs.

These insects are of small size; they vary in the time of their flight; the Pterophori, being crepuscular, flying over low plants; whilst Alucita frequents our gardens, and enters outhouses, sitting with its beautiful fan-like wings. The larvæ somewhat resemble those of the Arctiidæ, being clothed, although sparingly, with rather long hairs, with sixteen feet; they are very inactive (*fig.* 113. 20. larva of Pteroph. pentadactylus); the pupæ are variable, being either naked,

and enclosed in a transparent silken cocoon, or elongate-ovate, conical, hairy, and suspended perpendicularly by a thread, or affixed by hooks at the posterior extremity of the body to a layer of silk on leaves. The rays of the wings are composed of the nerves, without any of the intervening membrane, which seems to be transformed into the fringe. In repose, the Pterophori have the habit of folding their wings so as to appear to consist of only a single broad ray. Réaumur has represented the details and transformations of several of the species in his *Mémoires*, tom. i. pl. 19, 20., as has also De Geer *Mém*, tom. ii. pl. 4. f. 1—11. L'Admiral and Harris have also figured the transformations of Pteroph. pentadactylus.

The genus Agdistes *Hubner* differs from the rest in having the wings entire.

ORDER HOMOPTERA* *MacLeay.*

(OMOPTERA *Leach;* HEMIPTERA p. *Linn.;* RHYNGOTA p. *Fabric.*)

CHAR. Wings four, entirely membranous and deflexed; the anterior larger than the posterior, and not lapping over each other in repose.

Body convex.

Antennæ generally very short and setigerous.

Tarsi not more than 3-jointed.

Mouth arising from the under and hinder surface of the head, promuscidate, the mandibles and maxillæ being setaceous and enclosed in the labium, which forms an articulated canal. (See Vol. I. p. 9.)

Pupa active, semicomplete (*Metamorphosis* semicomplete *Fabr.*).

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Stoll. Naturlyke en naar't leeven, &c. (Representation des Cigales et des Punaises, &c.) Amsterdam, 4to. 1780. (29 pl. Cicadæ.)

Germar, in his Mag. d. Entomol. vol. iii. and iv.— Ditto, in Thon's Entomol. Archiv. band ii. 1830. — Ditto, in Silbermann Rev. Ent. tom. i. 1833, tom. ii. 1834. — Ditto, in his Zeitschr. f. d. Entomol. no. 1, 2.

The insects composing this order comprise some of the most anomalous forms to be met with in this class of animals. The musical Cicadæ, the strangely formed lanthorn flies, the cuckoo-spit insects, the destructive aphides, and the extraordinary scale-insects, are all types of well-marked groups in the order, agreeing together in the more or less membranous nature of their four wings, their promuscidate mouth, and their transformations. The body is generally thick and convex, rather than depressed; the wings consequently assume a deflexed position in repose; the promuscis arises much nearer to the breast than in the Heteroptera, having sometimes the appearance of being pectoral; the antennæ often arise from the under surface of the head, being mostly short, the basal joint very thick, and the terminal ones very slender and setigerous; the segments of the thorax form a solid thick ovate mass, the anterior being generally shorter than the following; the tarsi are always very short, and never have more than three joints. All the insects of this group subsist upon vegetable juices, which they obtain by the assistance of their promuscis. Sometimes, as in the case of the Aphides, Cocci, and sugar-cane fly (Delphax saccharivora), the injuries which they thus commit upon plants is very considerable. In some species, the promuscis is almost as long as the body, the labium itself being of that length, as in the Fulgoræ; but in others it is extremely short, the four internal setæ not much exceeding the labium in length; in the Coccidæ, however, these setæ are exceedingly long, but retractile, the sheath itself being very minute. The females are often furnished with a scaly ovipositor, composed of several toothed saws, lodged, when at rest, in a bivalve sheath at the extremity of the under side of the abdomen; being enabled, with this apparatus, to make an incision in the leaves or stems of plants, into which they afterwards introduce their eggs.

Say, in Journal of Acad. Nat. Scienc. Philadelph. vol. vi. p. 2,

Serville and St. Fargeau, in Encyclop. Méthod. tom. x.

Dufour. Recherches Anatomiques et Physiol. sur les Hémiptères. Paris, 1833. 4to. (Extr. from Mém. des Sav. E'trangers, tom. iv.)

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Guérin, in Voyage de la Coquille. — Ditto, in Voyage Duperrey et Belanger.

And the general works of *Linnæus*, *De Geer*, *Palisot Beauvois*, *Coquebert*, *Perty* (Del. An. Art. Brazil.), *Zetterstedt*, *Curtis*, &c.

A remarkable peculiarity, exhibited by great numbers of these insects, is the secretion of a fine farinose matter, often in very great quantities; and which occurs, not only in the typical tribes, but also among the Aphides, where a genus is even named, from this circumstance, Eriosoma; and the Coccidæ, where, at least in some species, the secretion forms large scales, as in the female Dorthesiæ, or greatly elongated anal filamentous fascicles, as in the males of that same genus.

* The characters of the wings, mouth, and transformations, upon which, as we have already seen (Vol. I. p. 18.), the three principal modes of distribution of the class have been built, separate this order from all the other suctorial insects; the differences, however, existing between them and the Heteroptera are confined chiefly to the first of these characters, and hence the propriety of the separation of these two groups has been denied by many subsequent writers. De Geer, indeed, first separated these as an order, named Siphonata by Retzius. Latreille, however, in most of his works, and Fabricius considered them as forming together but one; the former dividing it, under the name of Hemiptera, into two suborders or sections, Heteroptera and Homoptera. It cannot be denied that the characters they have in common are so numerous and strong, that disagreement in the texture of the wings is not alone sufficient to warrant their separation. If, however, we adopt the separation of the Phryganeæ from the Neuroptera, and the Forficulæ from the Orthoptera, we are, as it seems to me, equally warranted in considering these two groups as quite as much entitled to the rank of separate orders. Another consideration has also much weight with me in retaining the order as distinct, namely, the analogical relations which exist between the mandibulated and suctorial tribes. Mr. MacLeay, we have seen (Vol. I. p. 27.), regards the Hemiptera (Heteroptera) as opposed to the Orthoptera, and the Homoptera as analogous to the Neuroptera; but neither of these relations appears to me well founded. The Heteroptera, on the one hand, I consider as offering a far stronger series of analogies with the Coleoptera (such as the general shape of the depressed body, size of the scutellum and antennæ, and, more definitely, the Buprestis-like form of some of the equally splendid Scutelleræ; the Coleopterous form of others, as Odontoscelis scarabæoides, Thyreocoris melolonthoides *Burm.*, Th. silphoides *Fab.*, or Cephalocteus histeroides *Duf.*; or the Dyticus-like form of the equally aquatic Naucoris and

Belostomæ); whilst, on the other hand, the Homoptera seem to me to present as equally strong a series of relations of analogy with the Orthoptera, such as the uniform texture of the fore wings, their laterally deflexed position, and especially the saltatorial and musical powers possessed by many of both groups, and the complicated structure of the female ovipositor. In this respect, therefore, there is so strong a distinction between the two groups that I am tempted to retain them as distinct, although I might not have regarded their structural differences alone as sufficient.

The situation in which these insects are here arranged (between the Lepidoptera and Heteroptera), is equally liable to discussion. That they must be placed in immediate contact with the Heteroptera, is evident from what has been already said, and from the gradual approximation to them made by the Hydrocorisæ amongst the Heteroptera in the minuteness of their antennæ, the shortness of their conical promuscis, &c.; but their relation, on the other hand, to the Lepidoptera is much less clearly to be perceived. If, indeed, we look in the most general manner at the suctorial series of insects, we find the Homoptera agreeing better with the Lepidoptera than any of the other orders in their tetrapterous condition; the Heteroptera, and still less the Diptera, offering a slighter relation in this respect. This, however, it must be remembered, rests but upon a solitary bond of relation. Mr. MacLeay, indeed, brings forward the genus Flata *Fabr.*, the species of which, according to Latreille, "rassemblent à de petites Phalènes ou mieux encore à des Pyrales" (Tortrices), and especially the Flata limbata, as exhibiting a singular example of the commencement of a relation of affinity; the elongated antennæ, farinose wings, and shape of the head, especially receding from the Homopterous, and approaching the Lepidopterous type. The genus Aleyrodes *Latr.* (Tinea proletella *Linn.*) is also regarded as exemplifying the immediate transition or osculant order between the Homoptera and Lepidoptera, undergoing an obtected metamorphosis, being inactive in the pupa state, and in its adult state being covered with farinaceous powder. It is impossible not to be struck, however, at once with the slight nature of these proposed relations, leading to the conviction of the great hiatus which exists between the two orders in question.

Another interesting circumstance connected with this order in its restricted state is the great modification which even its most characteristic marks undergo in some of the more obscure tribes. The

Thripidæ, ordinarily regarded as portions of this order, we have seen possess a mandibulated palpigerous mouth, and hence they have been removed to the neighbourhood of the Orthoptera. In like manner, amongst the Aphides we find some species destitute of wings; and even amongst the Cicadæ of Linnæus, some of the species have the fore wings as leathery as in many of the Coleoptera: but it is in the Coccidæ that we find the greatest aberrations, for here, at least in the typical species, the alary and metamorphotic characters are lost, the only tie being that of the suctorial mouth, and even its parts are widely different from those of the true types of the order; whilst the dipterous halterated condition of the males destitute of a mouth, and at the same time undergoing an inactive metamorphosis, bespeaks as complete a want of conformity with the order as can be produced — sufficient, indeed, in the opinions of some authors to raise them into a distinct order; De Geer and his commentator Retzius having separated them under the name of Proboscidea, and Laporte under that of Phauloptères, the last-named author having also separated the Aphides as another distinct order, under the name Gynaptères. (*Etudes Entomol.* p. 7.) I think it however more advisable, in the present state of the science, to retain these two groups as portions of the order.

In this extent we accordingly find the order divided by Latreille into four families, in his *Genera;* namely, Cicadariæ, Psyllidæ, Aphidii (including Thrips), and Gallinsecta (Coccus). In his later works, however (*Règne Animal,* 2d ed. tom. v. p. 224.), we find the Psyllidæ reduced to a division of the Aphidii, whilst Burmeister, who adopts the views of Nitzsch as to the relations existing between the Pediculi and the Fabrician Rhyngota, or haustellated Hemiptera of Linnæus, and likewise introduces the Heteroptera into the order, for which he retains the name of Rhyngota (rejecting that of Linnæus; the mouth and not the wings being his primary character), divides it into six stirpes: Pediculina, Coccina, Phytophthires (including two subdivisions, Aphidina and Psyllodes), Cicadina, Hydrocores, and Geocores. Of these, the second, third, and fourth stirpes constitute the present order.

Mr. Stephens, on the other hand, divides the order into seven primary families: Cicadiidæ, Fulgoridæ, Cercopidæ, Psyllidæ, Thripidæ, Aphidæ, and Coccidæ. Of these, the first three are of much less relative value than the rest; the fourth is too closely allied to the Aphidæ to be considered as a distinct primary group, and the fifth must be removed from the order.

Retaining therefore, as usual, the family terminations for the secondary sections, and adopting Latreille's and Burmeister's views as to the division of the order into three primary sections, I propose to name these, in conformity with the gradation in the number of their tarsal joints:—

1. Trimera. Tarsi 3-jointed; antennæ minute, setigerous; wings areolate. (Cicada *Linnæus.*)
2. Dimera. Tarsi 2-jointed; antennæ moderate, filiform, 5—10-jointed; wings subareolate. (Aphis *Linn.* and Psylla *Geoffr.*)
3. Monomera. Tarsi 1-jointed; antennæ 6—25-jointed; wings not areolate. (Coccus *Linn.*)

The first section, TRIMERA, corresponds with the Linnæan genus Cicada, or the family Cicadaires of Latreille, and comprises the most numerous portion of the order, consisting of the largest and most beautiful of the species, and which have ordinarily three joints in the tarsi, and very small antennæ, composed of three or six joints terminated by a slender seta; the ocelli are generally present, being either two or three in number; the wings are varied in their consistence in different species, but the upper pair never exhibit two different textures, so remarkable in the Heteroptera. The species are generally saltatorial; the hind legs, however, are never disproportionately incrassated, as we have seen to be the case in other saltatorial species. The thorax undergoes several modifications of structure; in the typical species the prothorax is distinct and transverse, and the mesothorax, as seen above, occupies nearly the remainder of the thorax, being narrowed behind into a kind of scutellum, leaving the metathorax only visible at the sides; on the under side the three segments of the thorax are nearly of equal size. In Membracis, Cercopis, &c., the prothorax is greatly enlarged in size, and often singularly developed, and the mesothorax is reduced to an ordinary sized scutellum; in all, the metathorax above is reduced to a very small size. The abdomen of the females is furnished with a complex instrument for boring into the stems of plants, in which they deposit their eggs.

This section of the order has been especially investigated by Dr. Germar, who has described a very great number of species in his

various memoirs; Dr. Burmeister has also added the descriptions of many genera and species in his *Handbuch der Entomologie*. Linnæus united them into two genera — Fulgora, characterised chiefly by its porrected head; and Cicada, dividing the last-named genus into, 1. *Foliaceæ* (or the g. Membracis *Fabr.*); 2. *Cruciatæ* (Centrotus and Ledra); 3. *Manniferæ*, "non saltantes," or the true Cicadæ; 4. *Ranatræ*, "saltatoriæ" (C. sanguinolenta, spumaria, &c.); and 5. *Deflexæ* (comprising an heterogeneous assemblage of species). Latreille, with greater precision in the characters of the sections, divided them as follows (*Règne Animal*, tom. v. p. 212.):—

A. Chanteuses. Antennæ 6-jointed; ocelli 3. (Cicada *Oliv.* or Tettigonia *Fabr.*)

B. Muettes. Antennæ only distinctly 3-jointed; ocelli 2.

1. Fulgorelles. Antennæ inserted beneath the eyes; forehead often rostrated.
2. Cicadelles. Antennæ inserted between the eyes.

Dr. Burmeister has added a fourth group, by separating Membracis, &c. from the Cicadelles; his groups being, 1. Cicadellina; 2. Membracina; 3. Fulgorina; and 4. Stridulantia. I have, however, preferred following the arrangement of Latreille, not considering the Membracides as sufficiently distinct from the other Linnæan Ranatræ; dividing the section, therefore, into three families, — Cicadidæ (Cicadiidæ *Leach*), Fulgoridæ *Leach*, and Cercopidæ *Leach*.

The first family, CICADIDÆ*, corresponds with the Cicadæ† manniferæ *Linn.*, the Chanteuses of Latreille, and the Stridulantia of Bur-

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* BIBLIOGR. REFER. TO THE CICADIDÆ.

Cleyer. De Cicadis Indicis, in Ephem. Misc. Acad. Nat. Cur. 1687. Obs. 49.
Germar, in Silbermann, Rev. Ent. vol. ii. (Monogr. Cicad.)
Olivier. Encycl. Méth. art. Cigale.
L. Dufour. Rech. Anat. sur l. Cigales, Ann. Sci. Nat. tom. v.
Meckel. Anat Cic. Plebeia in his Beitr. zur Vergl. Anat. b. 1. 1808.
And the general works of *Stoll, Germar, Encycl. Méth., Fabr.* (Syst. Rh.), *Burmeister, Guérin, Brullé, Donovan, &c.*

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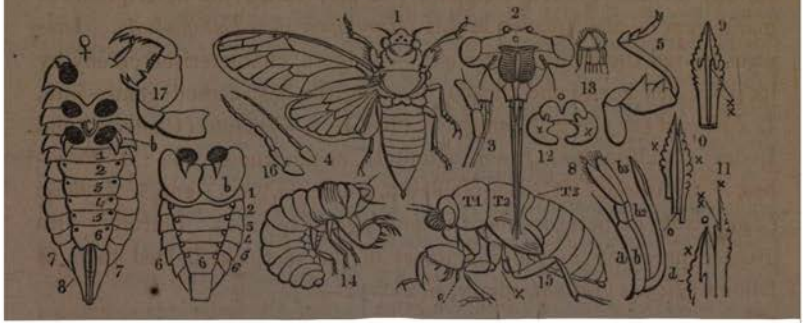
† The Latin name Cicada is derived by Beckman from the word *cicum* or

Fig. 114.



meister, which last names they have received on account of the musical powers possessed by the males (*fig.* 114. 1. Cicada Anglica). These are the largest insects in the order, one species measuring between six and seven inches in the expanse of its wings. The head is short, broad, and transverse, with large prominent eyes (*fig.* 114. 2. front of head of Cicada atrata); the ocelli, three in number, are placed on the back of the head in a triangle; the face has a large nearly circular swollen and transversely striated piece, close to which, at the upper angles, and between the eyes, the antennæ are inserted: these are, as it appears to me, composed of seven joints, although described as only 6-jointed by Latreille and others,—the basal joint being thick, and the others slender and gradually attenuated to the tip (*fig.* 114. 4.). The rostrum, promuscis, or, more strictly speaking, the labium, is greatly elongated and 3-jointed; the basal joint being very short (when seen from above, and in some species not perceivable), the terminal joint very long and slender (*fig.* 114. 2.; 3. base of promuscis sideways); the mandibles and maxillæ are represented by four fine setæ passing through the promuscis, and the palpi are entirely wanting. The prothorax is short and transverse, the mesothorax very large, the metathorax scarcely visible above, except at the sides; beneath these segments are nearly equal (*fig.* 114. 7.

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ciccum, a thin skin, and ᾄδω, signifying a sound produced by the motion of a little skin. Others derive it from the Latin words "cito cadat," implying that the Cicadæ soon vanish, or are short-lived. The Greeks named them Tettix, and the smaller mute ones Tettigonia; the last of which names has been given by Fabricius to the true Cicadæ, whilst Latreille applied it to the smaller species. Burmeister conjectures that Cercopis sanguinolenta was the true Tettigonia.

under side of the body of the female). The abdomen is short, and somewhat triangular (*fig.* 114. 6. under side of abdomen of male); the legs are short, the anterior femora thickened and toothed beneath (*fig.* 114. 5.); the posterior tibiæ slightly spined, without terminal spurs. The tarsi, except in a few species of Cicadæ *, are 3-jointed; the fore wings are large and rather narrow, deflexed at the sides of the body, and of an uniform consistence, with comparatively few and very distinct nervures, except in Hemidictya frondosa *Burm.*, and Polyneura ducalis *Westw.* (a beautiful insect brought from India by General Hardwicke), in which they are thickly reticulated. In a few species, C. stridula *Linn.* &c., the base of the forewings exhibits a decided space, somewhat more coriaceous than the rest of the wings; but, in the majority, they are completely membranous and delicately transparent.

The structure of the legs does not permit these insects to leap; but the more peculiar characteristic of the group consists in the structure of the apparatus, whereby the males are enabled to execute the long-continued and monotonous music, for which they have been so long famed; these organs are internal, and are placed at the base of the abdomen beneath, and covered by two large flat plates attached behind the place of insertion of the hind legs, varying in form in the different species †, being, in fact, the dilated sides of the metasternum (*fig.* 114. 6. b ♂. 7. b ♀). The peculiar construction of the internal double apparatus has been carefully investigated by Réaumur (*Mémoires*, tom. v.), and more recently by Goureau and Solier (*Annales Soc. Ent. de France*, 1837, and also in the Crochard edition of the *Règne Animal; Ins.* pl. 95.), and which consists of a pair of stretched membranes, acted upon by powerful muscles. The sound issues out of the two holes beneath the above-mentioned plates, in a manner somewhat analogous to the action of a violin. (See also Latreille's dissertation on musical insects, in the *Mémoires du Muséum*, tom. viii.)

The song of the Cicada has been a favourite theme in the verses

* The species with 2-jointed tarsi form Latreille's genus Tibicen, C. plebeia, tympanum, mannifera, &c.

† The chirping varies considerably in different species, probably according to the size of the drums. Captain Hancock states that some sing so loud as to be heard to the distance of a mile. The song of a Surinam species so much resembles the sound of a lyre that the species is thence called the harper (Lierman).—Merian, *Surin.* p. 49. The Chinese, as well as the Greeks, kept these insects in cages for the sake of their song.

of every Grecian bard from Homer to Anacreon. The hieroglyphics of Egypt also represent these insects as objects of attention, and in which they were emblematically represented as ministers of religion. That their music was not held by all in equal estimation, is evident from the line of Virgil —

> " Et cantu *querulæ* rumpent arbusta Cicadæ ;"

whilst the same poet also alludes to their singing in the hottest sunshine, —

> " Sole sub ardenti resonant arbusta Cicadæ :"

and the Rhodian bard Xenarchus notices the peculiarity of the males alone being possessed of the power of singing, in his couplet--

> " Happy the Cicada lives,
> Since they all have voiceless wives."

It is impossible to allude to the numerous fables related of these insects by the poets of antiquity (amongst which the story of Tithonus turned into a Cicada by Aurora is pre-eminent); I must therefore content myself by referring to Kirby and Spence's *Introduction*, or to my article Cicada, in the *British Cyclopædia of Natural History*. Burmeister has also collected much classical lore respecting these insects, in his *Handbuch*, vol. ii. p. 175., nor must old Mouffet be forgotten.

The curious apparatus with which the females are provided, for enabling them to make slits in the branches of trees for the purpose of depositing their eggs therein, consists of several pieces, admirably fitted together. On examining the under side of the body of the female (*fig.* 114. 7.), the eighth dorsal segment is seen to be deflexed at the sides, forming a groove beneath, enclosing two valves articulated in the middle, as represented in my *fig.* 114. 8. b, b 2., b 3., and by Percheron, *Gen. d. Ins. Hemipt.* pl. 2., Réaumur, tom. v. pl. 18. f. 3. *, which unitedly form a kind of scabbard to a cylindrical horny borer, much curved at the base (*fig.* 114. 8. d) and dilated into a lanceolated point at the extremity; on viewing which from beneath (*fig.* 114. 9.), it appears serrated on each side, and furnished with two more coriaceous narrow plates (*fig.* 114. 9. x), which, however, are but the incurved edges of the two files of the borer, which have an alternate and

* Burmeister only represents one articulation in the middle; see his pl. 24. f. 1. A, B, and f. 2. B, C.

separate motion, and are supported by a single piece at the back (*fig.* 114. 10. o, x and x being the two lateral files, one partially pushed forwards; 114. 11. represents these three pieces in another position, showing more clearly that $\frac{x}{x}$ is but the produced edge of x). This instrument has been carefully described by Réaumur (tom. v. pl. 18.), who represents in his various figures the alternate protrusion of the lateral files, as well as the central groove down the back of the supporting dorsal piece. On inspecting this last piece, it appears probable that it consists of two pieces firmly soldered together. I do not, however, believe that these two pieces have the slightest motion independent of each other, or open at the tip, as represented by Burmeister, *Handb. Transl.* pl. 24. f. 3, 4. This author has further described and figured the two lateral files as united together, and forming a "superior distended sheath, with teeth on the margin *," and the dorsal supporting piece as "the lower setæ," evidently considering this part as consisting of two setæ, enclosed in the distended sheath; and as the point of this supporting piece is represented as bifid and protruded considerably beyond the extremity of the serrated lateral organ, it is evident that Burmeister considers the middle piece as the piercing part, and the serrated part as the supporting sheath: so also M. Doyère, in the Crochard edition of the *Règne Animal* (pl. 95. fig. 2. i and 2. k), considers the serrated lateral pieces as performing, in the act of perforation, "les fonctions de grappins," and the central piece as "l'instrument réellement perforant;" but the peculiar structure of these lateral files, so admirably fitted for making incisions in vegetable fibre, and the curious form of the middle dorsal piece (*fig.* 114. 12. o.) grooved along the sides,—the groove being internally dilated, and receiving the dilated edge of the serrated piece, and thus retaining it in its place, (as represented in my *fig.* 114. 12. being a transverse section of these instruments †,)—are, I think, sufficient proofs that the serrated lateral pieces are the real organs of perforation, and that the dorsal piece is but an organ of support. I have dissected so many specimens

* Burmeister has certainly erred in regarding these two lateral serrated pieces as forming one organ; see his pl. 24. fig. 3. a a, 5. and 7. a a; whilst M. Doyère's two figures, 2. i and 2. k, give an incorrect idea, by omitting one of the lateral pieces in each figure.

† The figures of the transverse sections of these organs given by Burmeister and Doyère, are incorrect, the middle supporting piece being placed downwards instead of being represented as the dorsal part.

of Cicadæ, that I entertain no doubt as to the correctness of the description which I have given of these parts. My *fig.* 114. 13. represents an organ connected with the ovipositor, and placed within the tip of the terminal dorsal segment of the abdomen, which has been overlooked by all authors, but which appears to me to be the anus, the two terminal conical parts of which it is composed, opening with a slit in the middle.

The female Cicada deposits from five to seven hundred eggs; making choice of dead dried branches for their reception, being apparently aware that moisture would injure her progeny: the situations in which the parent insect has bored into the branches, and introduced her eggs, may be recognised by being covered with little oblong elevations, caused by small splinters of wood detached at one end, but left fixed at the other; these elevations are mostly in a line, but sometimes in two lines, at equal distances apart, and form the covering of so many burrows, about one third of an inch long, each containing from four to ten eggs. M. Pontedera asserts that the parent closes the mouth of these burrows with a layer of gum impervious to the air *, but Réaumur considers this not correct. The young grubs, when hatched, are stated by Réaumur to resemble the flea in form. He also observed that the eggs were attacked by the larvæ of an ichneumon, which he also found in the burrows. The young larvæ have six feet, and make their escape out of the opening of the cell left by the parent for that purpose, descending immediately into the earth, where they increase in size, in the form of hexapod grubs, furnished with a cylindrical proboscis and thick fore legs (*fig.* 114. 14.), and where they are transformed into active pupæ, differing only from the larvæ in having the rudimental wings visible at the sides of the body (*fig.* 114. 15.). In this state they were known to the ancients, Aristotle calling them Tettigometra, or mother of the Cicadæ. The two fore segments of the thorax (T 1. and T 2.) are well developed, and the metathorax (T 3.) is transverse, and although short, is seen from above; the abdomen is composed of eight segments; the meso-sternum is produced into a large tubercle (*fig.* 114. 15. ×), which is also found in the imago; the antennæ are thicker than in the imago, and 9-jointed

* This statement probably had its origin in the supposed production of manna upon trees, resulting from the puncture of the proboscis of the imago of Cicada orni; whence Linnæus named these insects Manniferæ. M. L. Dufour, however, doubts whether this statement is well founded.

(*fig.* 114. 16.); the fore legs are very robust, and fitted for digging, with very large coxæ, strongly toothed femora, raptorial tibiæ, 2-jointed tarsi, the basal joint being very small (*fig.* 114. 17.); the pupa (described by the editor of the Crochard ed. of the *Règne An. Ins.* pl. 95. f. 2. a, and other French authors, as the larva) does not exhibit any rudiments of the sexual peculiarities of the imago. During the winter these immature insects burrow to the depth of two or three feet into the earth, and from all the recorded observations it appears that it is from the roots of plants that they derive their subsistence. In the pupa state they were eaten by the ancients, Aristotle stating, " quo tempore gustu suavissimæ sunt, antequam cortex rumpatur." In the perfect state they were also eaten, the same author adding, " et ante coitum mares suaviores sunt, a coitu feminæ quippe quæ ova candida gustu habeant grata."

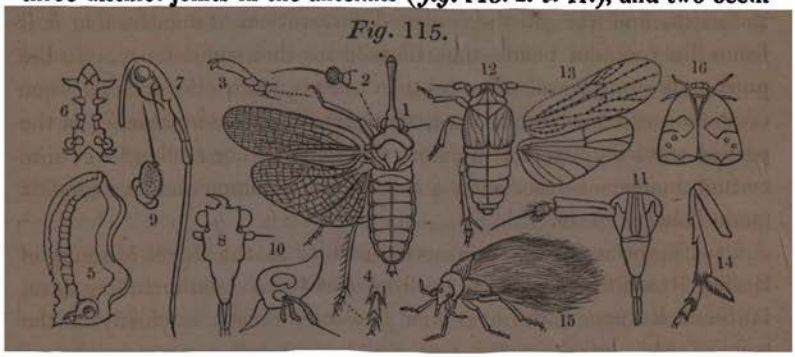
Of 150 species of these insects contained in the Royal Museum of Berlin, 70 are from America, 50 from Africa, 25 Asia, including Java, 10 South Europe, and 6 or 8 New Holland: thus it is chiefly in the tropical parts of the world that the largest and greatest number of species are found, those found in the centre of Europe being but small; one species only, of comparatively small size, is found in this country, which has been supposed to be the C. hæmatodes *Linn.*, but which Mr. Curtis has figured under the name of Cicada Anglica, (*fig.* 114. 1.). It is found in the New Forest. Mr. Curtis thinks this species does not sing, because a specimen kept in confinement by Mr. Dale for two or three days was mute. Kirby and Spence, however, were informed that it is very noisy, and analogy would lead to the belief that it does sing, the drums of C. Orni not being comparatively larger than in this species. Weaver found the pupa case of this insect attached by the legs to the stem of a fern, upon the roots of which he, as well as Curtis, supposes that the larva feeds. (*Mag. Nat. Hist.* No. 29. and *Ent. Mag.* vol. ii. p. 436.)

Cicada septendecim *Fab.*, an American species (so named because, according to Kalm, *Swed. Trans.* 1756, and *Travels*, 2. 6., it appears only once in seventeen years, and then in inconceivable numbers), does great damage both to fruit and forest trees in the United States. This species is still eaten by the native Indians. Collinson, in *Phil. Trans.* 1764, 54. 10. 65. See also Hildreth, on the Cicadæ of Ohio, in Brewster's *Edinb. Journ. of Science*, vol. xi. 1828. The septendecenary appearance of this insect has recently been confirmed by Dr.

Harlan. (See *Trans. Ent. Soc.* vol. i. App. p. 30., and *Annales Soc. Ent. France*, 1837, p. 31., and App. pp. 17. 39.)

The family FULGORIDÆ * *Leach* (*fig.* 115. 1. Fulgora apicalis, *Westw.*) is at once distinguished from the preceding by having only three distinct joints in the antennæ (*fig.* 115. 2. 9. 11.), and two ocelli

Fig. 115.



placed beneath the eyes (*fig.* 115. 5. 7, 8.). The legs are in general fitted for leaping, with large spurs (*fig.* 115. 14. hind leg of Delphax); and the males are destitute of those organs which are em-

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* BIBLIOGR. REFER. TO THE FULGORIDÆ.

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Hoffmansegg. Ueber das Leuchten der Fulgora, in Gesellsch. Naturf. fr. Berlin Mag. vol. i.
Kirby, in Trans. Linn. Soc. vol. xiii. (Anotia and Otiocerus). — Ditto, in his Century, and Brown's N. Holl. Ins. in ditto, vol. xii.
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Zetterstedt, Fauna lapponica.
Percheron, in Guér. Mag. Zool., Derbe and Cephalelus.
Waterhouse, in Trans. Ent. Soc. vol. ii. (Cephalelus and Alleloplasis).
Bohemann, in Swed. Trans. 1838. (Derbe).
Descourtilz. Mém. n. g. (Agenia), in Ann. Soc. Linn. Paris, 1824.
Spinola, in Guérin's Bull. Soc. Cuvierr. 1839, p. 199.
And the general works above referred to.

ployed in the Cicadæ for the production of sounds *; the antennæ are inserted immediately beneath the eyes, and the forehead is often singularly dilated in the form of a muzzle, varying in shape in the different species, and in some nearly equalling the rest of the body in length.

This is a much more numerous family than the preceding, and the species exhibit considerably greater modifications of form, comprising in fact some of the most singular of the insect tribes. In the typical genus Fulgora the head is dilated in front into the most remarkable porrected protuberances, varying in each species (*fig.* 115. 5. head of F. laternaria sideways, 6. ditto of F. diadema), and which is the part of the body asserted by various writers to emit a strong light by night, analogous to that of the fire-flies; in others, again, this part of the head is recurved in the shape of a horn (*fig.* 115. 7. head of Aphana nigro-maculata sideways, 8 itto in front); others, again, have it simple, but broad, with the front edge raised and acute; in many of the smaller species the face is longitudinally carinated (*fig.* 115. 11. head of Asiraca clavicornis in front); the antennæ are generally very small (*fig.* 115. 2. 9.), but in some they are considerably elongated; the ocelli appear to be wanting in Otiocerus (*fig.* 115. 10.), Pœciloptera Issus, and Asiraca (*fig.* 115. 11.). The first of these genera (or Cobax *Germar*) is remarkable for possessing two small palpiform appendages beneath the eyes, and attached to the base of the antennæ (*fig.* 115. 10.), of which the uses are unknown, and which have been found in no other insects. The proboscis varies considerably in length, being in some nearly equal to the whole body, and in others very short; the wings also differ very much in form, those of some species of Flata and some of the allied genera having them very broad and rounded or triangular, and sometimes with the hind margin emarginate: they also differ in their position in repose, in some being very much deflexed and in others carried horizontally, the latter having much the appearance of moths (*fig.* 115. 16. Ricania —?); there is also considerable difference in the veining of the fore wings (*fig.* 115. 1. and 13.), but in general they are very thickly reticulated: the spurs of the hind feet

* Kirby and Spence, on the authority of Stedman's *Surinam*, assert that Fulgora laternaria makes a loud noise in the evening, like that made by a razor-grinder, and that the Dutch in Guiana call it *scare-sleep*. Dr. Hancock, however, states that the razor-grinder, or the Aria Aria of the natives, is a species of Cicada. (*Proceed. Zool. Soc.* June 24. 1834.)

are large; in some of the smaller species which perform great leaps, they are very large and toothed (*fig.* 115. 14.); the tarsi are 3-jointed (*fig.* 115. 3 and 4.). In some species, also, the fore legs are curiously dilated, as in some Asiracæ, and especially in Laporte's minute Caliscelis heterodoxa.

The species of this family emit the white waxy secretion * above alluded to, and in some species to a remarkable extent: such is the case with Phenax variegata, Lystra auricoma *Kl.* (Burm. *Gen. Ins.* 1. 1.), L. lanata, &c.; many Flata, &c. This production is collected by the Chinese, and employed in the manufacture of the fine white wax so much esteemed in the East Indies. The insects by which this is produced are the immature states of a species of Flata (probably of F. nigricornis, as supposed by Donovan; my *fig.* 115. 15.). Du Halde, in his *Histoire de la Chine*, speaks of this production: "De la cire blanche faite par des insectes et nommée *Tchang pe la* †, c'est à dire, cire blanche d'insectes. *Ki* dit, ce sont de petits insectes qui la forment: ces insectes succent le suc de l'espèce d'arbres nommé *Tong tçin*, et à la longue ils le changent en une sorte de graisse blanche, qu'ils attachent aux branches de l'arbre. Il y en a qui disent que c'est la fiente de ces insectes qui s'attachant à l'arbre forme cette cire, mais ils se trompent. On la tire en raclant les branches dans la saison de l'automne; on la fait fondre sur le feu, et l'ayant passée, on la verse dans l'eau froide où elle se fige et se forme en pains. On la mêle avec de l'huile, et on en fait des chandelles. Elle est beaucoup supérieure à celle que font les abeilles."

"*Chi tchin* dit, les insectes sont fort petits; quand le soleil parcourt les quinze derniers dégrez des Gémeaux, ils se répandent en grimpant sur les branches de l'arbre; ils en tirent le suc et jettent par la bouche une certaine bave, qui s'attachant aux branches encore ten-

* This secretion, which is either cottony, or arranged in lamellæ is evidently analogous to the wax secretion of bees; it has not, however, yet been analysed. It appears to be generally secreted from all the parts of the outer covering of the body, but in some species, particular orifices are destined for this purpose. Thus, in Chermes (Psylla) abietis the cottony filaments are emitted from minute oval cavities on the dorsal part of the abdomen, each segment having four arranged transversely, and which under a high power exhibit minute tubercles pierced at the summit with a minute orifice.

† Some writers have stated that this *Pe la* is produced by a species of *Coccus*; and the account given by *Chi tchin* evidently alludes to a species of that family, Coccidæ (probably Ceroplastus); Sir G. Staunton's account clearly refers to a different creature: probably several species are thus used.

dres, se changent en une graisse blanche, laquelle se durcit et prend la forme de cire."

" *Tchi hen* dit c'est une drogue absolument nécessaire aux chirurgiens: elle a des effets admirables." (*Du Halde*, tom. iv. p. 495., large fol. 1735.)

Sir George Staunton, in his work on China, has also described and figured the wax insect which he found at Turon Bay, in Cochin China. Gordon also, in his description of China, notices this production as caused by vast numbers of little worms. (Donovan, *Ins. China*, p. 42.)

Much uncertainty exists as to the real existence of any luminous power possessed by the typical species of this family. This account originated with Madame Merian (*Insecta Surinam*, p. 49.), who asserted it to be possessed by Fulgora laternaria in an eminent degree, and her statement long received general assent, and appears to be the only authority for its existence. Olivier appears to be the first author who doubted the luminosity of the Fulgoræ (*Enc. Méth.* art. *Fulgore* *), from information given to him by M. Richard, who had reared the F. laternaria in Cayenne and had not found it to be luminous. Hoffmansegg (*Mag. Nat. Berl.* vol. i. p. 153.), the Prince Von Nieuwied (*Reise nach Bra.*. tom. ii. p. 111.), and still more recently M. Lacordaire (the two last-named authors having been long resident in South America), also concur in this opinion, none of the individuals they had ever seen alive exhibiting the least trace of luminosity. The majority of the natives also who had been questioned on the subject denied the luminous power, although a few affirmed it; hence Lacordaire suggests whether one sex may be luminous and the other not. (*Introd. à l'Entomol.* tom. ii. p. 143.) Rösel and Donovan imagined that the white farinaceous dots upon the snouts and bodies of these insects were phosphorescent, but they are clearly nothing else than particles of the waxen secretion above noticed. Dr. Hancock also read a memoir on the luminosity of the Fulg. laternaria before the Zoological Society, on 24th June, 1834, in which its luminosity is considered as entirely fabulous. M. Wesmael has recently reasserted the luminous property of the South American species on the authority of a friend who had witnessed it alive. (*Ann. Soc. Ent. de France*, App. 1837.) And W. Baird, Esq., has informed me of the

* Olivier, however, states that he had " souvent trouvé au midi de la France de grandes espèces de Cigales entièrement phosphoriques *après leur mort.*"

existence of a Chinese edict against young ladies keeping lanthorn-flies.

One species of this family, having habits similar to the Aphides, is extremely injurious in the West Indian Islands from its attacks upon the sugar-cane, which it often entirely kills, from the vast numbers of individuals with which the plants are infested. I have described and figured this insect under the name of Delphax saccharivora (*Mag. Nat. Hist.* vol. vi. p. 407.; and see *Trans. Ent. Soc.* vol. i. App. p. 28. and 70. for further details of its destructive ravages). A very remarkable species has been described by Mr. Waterhouse, from New South Wales, of minute size, having only two wings, which greatly exceed the body in length, and are linear and rather spatulate at the tip (Alleloplasis Darwinii, *Trans. Ent. Soc.* ii. p. 194. pl. 17. f. 4.).

Other instances in which the wings undergo a deficiency of development occur in the genus Delphax, the majority of w[illegible] in our English species, have the upper wings not covering more than half the abdomen, the terminal membrane being deficient as well as the hind wings. In certain sea[illegible]s, however, especially [illegible] the wings are fully best-known [illegible] *fig.* 115. [illegible] fully developed imago of De[illegible]ceps *Germar* [illegible] the wings of a fully developed indi[illegible]dual. Mr. C[illegible] formed the undeveloped specimens into a d[illegible]erent genus, Criomorphus.

The third family, CERCOPIDÆ*, differs from the two preceding in having the antennæ 3-jointed (*fig.* 116. [illegible] antennæ of Centrotus);

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* BIBLIOGR. REFER. TO THE CERCOPIDÆ.

Germar, in Silberm. Rev. Ent. No. 17, 18. (Monogr. Membracidum); and his Magazin d. Entomol. No. 3, 4.; and Zeitschr. f. Entom.

Laporte, in Ann. Soc. Ent. France, 1832 (Monogr. Heteronotus). — Ditto (Descript. n. genera).

Lewis, in Trans. Ent. Soc. vol. i. (n. Brit. genera).

Curtis, in Entomol. Mag. vol. [illegible]

Burmeister. Genera Insectorum. — Ditto, in Silberm. Rev. Ent. (Monogr. Darnis, &c.) — Ditto, Handb. d. Entomol.

Gistl, in Faunus, No. 2. 1837.

Waltl. Reise nach Spanien.

Eversmann. List of Russian Species, in Bull. Mosc. 1837.

Kirby. N. Sp. Centrotus, in Mag. Nat. Hist. No. 6.

Lesson, in Centurie Zoolog. (sp. of Centrotus).

Fig. 116.

the last forming an elongated seta, occasionally apparently articulated at the base (*fig.* 116. 3. ant. of Ledra), and inserted between, not beneath the eyes.

The ocelli also, two in number, are situated either on the forehead or the face (*fig.* 116. [illegible], head of Selenocephalus beneath, with the ocelli on the extreme [illegible] of the forehead; 116. 8. face of Centrotus); the head [illegible] in front into a proboscis; the legs are fitted for [illegible] are destitute of [illegible] organs.

This [illegible] consis[illegible] species of small size, and in one [illegible] many most singular creatures; the majority [illegible] however, tropical. The head is of small or moderate [illegible], with the face broad (*fig.* 116. 2. 16.), the eyes [illegible] inserted in the middle or lower part of the face; [illegible] (*fig.* 116. 16.), or but of moderate length (*fig.* 116. [illegible] 116. 2., head of Ledra beneath) and 3-jointed; the prothorax very variable in form and size, and in the sub-family Cercopides being the portion of the body which assumes the remarkable forms above alluded to; instances of this are represented in *fig.* 116. 7. Centrotus biclavatus *Westw.*; *fig.* 116. 11. Heteronotus nigricans *Lap.*, and *fig.* 116. 13. Membracis — ?; but this part exhibits an almost endless variety and grotesqueness of form and anomalous development. In the Tettigonides the prothorax is of the ordinary form and size, leaving the scutellum exposed (as in *fig.* 116. 1. Ledra aurita); the

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H. Schäffer. Nomenclator Entomologicus, and Continuation of Panzer.
And the general works of *Linnæus, Fabricius, Panzer, Palisot Beauvois, Perty, Guérin, Griffith* (An. Kingd.), *Curtis, &c.* (*Encycl. Méth.* tom. x.).

fore wings differ in their consistence, but the majority have them strongly veined, forming cells closed before reaching the extremity of the wing (*fig.* 116. 9. fore-wing of Centrotus). This type of neuration occurs in both subfamilies, as does also the mode of neuration of the hind wings. The hind tibiæ vary in structure, being in some nearly simple (*fig.* 116. 17. post. tibia of Centrotus); in others, furnished with a few strong spurs (*fig.* 116. 18. post. tibia of Cercopis); and in many being triangular or quadrangular, each angle emitting strong spines (*fig.* 116. 19. part of post. tibia of Cœlidia). The tarsi are 3-jointed (*fig.* 116. 12.). The abdomen of the females is furnished with a multivalve ovipositor, variable in its form in the different species (*fig.* 116. 5. apex of abdomen beneath of Ledra aurita ♀, 116. 4. ditto ♂).

The species are often beautifully varied in their colours; they are constantly found amongst plants, and on trees, upon the juices of which they subsist, in all their states, by introducing their rostrum into the stems or leaves; the larvæ being entirely destitute of any appearance of wings, and the pupa having them rudimental.

One of the best-known insects in this family is the Aphrophora spumaria *Germ.*, a species of small size, which frequents garden plants, the larva and pupa (*fig.* 116. 14.) investing themselves with a frothy excrementitious secretion (*fig.* 116. 15.), which has given rise to various fancies: "Cuculorum nascuntur spumo," was the notion entertained by the ancients; whilst the modern names "frog-hopper" and "crachat de grenouilles," indicate their supposed origin from another tribe of animals. The history of this species has been traced by Swammerdam, De Geer (in *Swed. Trans.* 1741; and in his *Mém.* tom. iii.), and Rösel.

A species of Aphrophora (A. Goudotii *Bennett*) is also found in great quantities upon trees in Madagascar, the larva of which has the power of emitting a considerable quantity of clear water, especially in the middle of the day, when the heat is greatest. (See *Proceedings of the Nat. Hist. Soc. Mauritius*, Sept. 12. 1832; and *Proc. Zool. Soc. London*, Jan. 22. 1833.)

The history of an allied species, Cercopis sanguinolenta, the most beautiful insect of the order found in this country, has also been investigated by Goeze in *Der Naturforscher*, st. 6. and by Schrank in *Schrift d. Berlin Gesch. Natur.-freund.* b. 2.

I have already alluded (*antè*, p. 234.) to the statement of M. Lund,

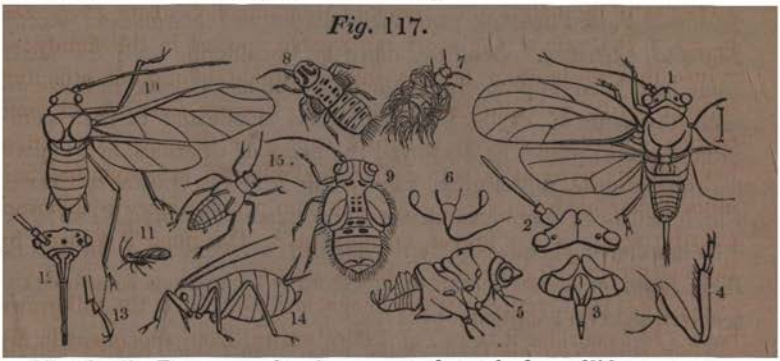
and the drawings of General Hardwicke, as to these insects being used by the ants instead of Aphides, for obtaining a supply of saccharine fluid; the same fact is also recorded by Spix and Martius (*Delect. Anim. art. Brasil. Introd.* p. 24.), as well as by Beske, as published by Burmeister (Silberm. *Rev. Ent.* No. 5.; see also Rev. L. Guilding in *Mag. Nat. Hist.* No. 43.). Mr. Swainson also, unacquainted with these authorities, has stated the same fact as one unknown, in his just published *Treatise on the Instincts of Animals.* Burmeister, in his monograph on Combophora, quotes the following statement of Beske as to the habits of C. Besckii (Membracis cucullata *Perty, Del.* pl. 35. f. 9.), one of the most remarkable species in the family:— "Insectum declaratum hostem saltans timide effugit, et pronotum in fuga perdit sed nunquam recuperat. Semper *formicam* id comitantem observavi, *succum* e suturâ capitis et thoracis exsudantem haurientem; nympha insecto declarato similis sed pronotum brevissimum abdominis basin vix tegens, globulum parvum apice trispinosum emittit; elytra et alæ breves incompletæ." The pupa is figured by Burmeister, loc. cit., together with the imago.

My *fig.* 116. 1. represents the imago, and *fig.* 116. 6. the full-grown larva (as I consider it to be) of Ledra aurita, from specimens in my collection; the latter exhibiting only the rudiments of the prothoracic elevations, and the wing-cases not being so much developed as they are in the more mature state of pupæ, nor extending beyond the metathorax. I also possess a very young larva of the same insect, in which these peculiarities are still less evident. I also possess the pupa of Centrotus Genistæ, in which the prothoracic elevation is but slightly developed, but the abdomen is considerably elongated and attenuated at the tip. The curious insect figured by Stoll, pl. 16. f. 85., having a long furcate horn arising from the prothorax, and several pairs of elevated spines from the abdominal segments, and which Laporte has raised into a genus under the name of Acanthicus (*Ann. Soc. Ent. France,* tom. i. pl. 6. f. 7.), appears to me (from a specimen in my collection) to be a pupa of some species of Centrotus, the four wing-cases being well developed. Such also is the opinion of Germar in Silberm. *Rev. Ent.* N. 4.

The section DIMERA of the order comprises much smaller insects than the preceding, from which they are distinguished by having only

two joints in the tarsi, with antennæ longer than the head, and composed of from six to ten filiform joints; whilst they differ from the Monomera by the winged individuals possessing four wings, the anterior being ordinarily of the same membranous texture as the posterior. The section consists of the families Psyllidæ, Aphidæ, and Aleyrodidæ; the genus Aleyrodes disagreeing so much from the Aphidæ, in which it is placed by Latreille, and from the Coccidæ, in which Burmeister arranges it, that I have thought it most natural to consider it as forming a distinct family.

Fig. 117.



The family PSYLLIDÆ has long or moderately long filiform antennæ composed of ten joints, the basal one being thick, and terminated by two short setæ (*fig.* 117. 1. Psylla —?, the largest British species); in Livia they are much shorter, with the second joint very greatly dilated; they are inserted in front of the eyes, at the sides of the head, which part of the body is deeply cleft in front; the eyes are lateral and prominent, the ocelli, three in number, placed in a triangle, the posterior ones close to the eyes (*fig.* 117. 2. head above); the promuscis is short, triarticulate, arising almost between the fore legs (*fig.* 117. 3. head beneath), enclosing several very slender elongated setæ, capable of being thrust out to a great length, as in *fig.* 117. 6.; the thorax is of a very large size, the prothoracic collar is very short, the mesothorax and metathorax fully developed, the former composed of several parts (*fig.* 117. 1.), terminated by a small scutellum. Beneath, the epimera of the metathorax are singularly produced behind the place of insertion of the hind legs (which are pushed forwards), and terminated by two strong spurs (*fig.* 117. 5. body sideways); the tarsi are composed of two joints (*fig.* 117. 4. hind leg); the wings, which occur in both sexes, are deflexed at the sides of the body, the fore

wings being of a firmer consistence than the hind wings, and furnished with three strong furcate nerves; the nerves of the hind wings are very delicate; the abdomen is small, and terminated in the females by a plurivalve conical ovipositor (*fig.* 117. 1.), and in the males by several erect appendages (*fig.* 117. 5.). The general habit of these insects is very similar to that of some of the Cicadæ, with which they also agree in their saltatorial powers and deflexed wings: hence, as well as from other circumstances, M. Dufour considers them intermediate between the Cicadellina and Aphides. They were named by Réaumur Faux Pucerons, from their relation to the Aphides; and by Linnæus, Chermes. Geoffroy, however, considering that the latter name had been improperly employed by Linnæus, gave to these insects the name of Psylla, from the Greek, in allusion to their saltatorial powers; whilst he employed the name of Chermes, in its more legitimate sense, to designate some of the Linnæan species of Coccus which had been employed as dyes, the names Chermes, Kermes, or Alkermes having been given by the Arabians and Persians to the Coccus Ilicis *Linn.*, or famed Tyrian dye: Geoffroy's name has consequently received general adoption.

They subsist in all their states upon plants, and have received specific names from the various trees and vegetables which they frequent. The species, however, require an attentive investigation, the majority being known only by their habitat, and not by any detailed specific description. Their larvæ (*fig.* 117. 8. larva P. Betulæ denuded) have the body very flat, the head broad, and the abdomen rounded behind; the tarsi are terminated by a small membranous vesicle with two ungues; the antennæ are stated by Dufour to consist of only one joint; the pupæ (*fig.* 117. 9. pupa P. Betulæ) are distinguished by having four large and broad scales on the back, which are the rudimental wings. Many species in the preparatory stages are covered with a white cottony secretion (*fig.* 117. 7. larva P. Betulæ), and their excrement forms threads or masses of a gummy sucreous nature. Some species also, by puncturing vegetables, in order to suck the sap, occasion the production of gall-like monstrosities, especially upon the leaves and buds. Psylla Buxi, whose history is traced by Réaumur (*Mém.* tom. iii. pl. 29. f. 1. 16.), causes the terminal shoots and young leaves of the box tree to assume the appearance of buds. The same author has also represented the details of the history of the species which lives on the fig (tab. id. f. 17—24. P. Ficus *Latr., L. Dufour, Geoffr.* pl. 10. f. 2.); whilst De Geer has in

like manner illustrated Ps. Pyri, Urticæ, and Betulæ, the last of which in the larva state is densely enveloped in a cottony secretion. Two species, Psylla Pyri and Chermes Mali *Schmidberger*, are very injurious in orchards, the former to the young shoots and leaves of the pear, and the latter to the apple. The history of these two species is given in Kollar's *Treatise on Insects injurious to Gardens, &c.* translation, p. 275—284.; and some particulars relative to the pear Psylla were published by Mr. Knight in *Hort. Trans.* 2d series, vol. ii. p. 107.; and *Gard. Mag.* (Loudon) No. 92., Nov. 1837. Latreille has given us the history of a curious species, Livia Juncorum, which inhabits the common Juncus articulatus, depositing its eggs in the flowers, or at least in their shoots: the action of the sap produced a monstrosity in the diseased part, resembling a bundle of grass, within which the insects reside in their different states, supporting themselves on the juice of the plant, and emitting a white farinaceous excrementitious secretion, in the midst of which they delight to reside. (*Bull. Soc. Philomat.* tom. i., and *Hist. Nat. Fourmis*, p. 325.) Mr. Curtis has figured this insect (*Brit. Ent.* pl. 492.), and has stated that he detected three joints in the tarsi; the basal joint being, however, scarcely visible, except in the hind legs.

The family APHIDÆ* comprises the very numerous and obnoxious species of plant lice (*fig.* 117. 10. Aphis Persicæ), a tribe of insects

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* BIBLIOGR. REFER. TO THE APHIDÆ.

De la Hire. Obs. sur l. Pucerons, in Mém. Acad. Sc. Paris, 1703.
Bonnet. On Aphides, in his Œuvres, tom. i.
Richardson. Obs. on the Aphides of Linnæus, in Phil. Trans. 1771.
Bjerkander, in Swed. Trans. 1784.
Hausmann. Beitr. d. g. d. Blattlause, in Illiger. Magaz. zu Insekt. b. 2. 1802.
Kyber. On ditto, in Germar's Magazin d. Ent. 1812.
Dutrochet. Anat. Aphides, in Annales des Sci. Nat., Oct. 1833.
Duvau. Nouv. Rech. sur l'Hist. n. de Pucerons, in Mém. Mus. d'Hist. Nat. tom. xiii. 1825, and Ann. Sc. Nat. tom. v.
Kittel, in Ann. Soc. Linn. de Paris, tom. v.
Boyer de Fonscolombe, in Ann. Soc. Ent. de France, tom. iii. (Phylloxera.)
Haliday, in Annals of Natural History, Nov. 1838.
Ferussac. Puceron de Therebinth, A. Pistaciæ, in Nouv. Bull. de Sci. tom. iii.; and in Bull. Soc. Phil., 1812, 1813.
Macquart. Puceron du Blé, in Ann. Sci. Nat., April 1831.

analogous, in regard to the vegetable world, to the animal parasites of the order Anoplura, or lice; and which, from their constant occurrence in great numbers upon almost every species of plant, must have attracted the attention of every observer: from the Psyllidæ they are at once distinguished by their antennæ being only 7-jointed; from the Aleyrodidæ by the more numerous veining of their wings. The rostrum is more or less perpendicular or inflexed, varying in length, being in some species nearly half as long as the body, and consists of four joints (*fig.* 117. 12 head of Cinara Pini? *Curt.*). Latreille describes the labium as 3-jointed, and Curtis as 5-jointed; the terminal joint described by the latter appears to me to be the exserted tips of the enclosed setæ; the labrum is long and pointed at tip; the antennæ are of moderate or great length, and consist of seven joints, the last being sometimes obsolete, and the third the longest. The ocelli, three in number, form a large triangle; the eyes are entire, prominent and semiglobose. The thorax is oval, with the prothorax forming a transverse collar; the abdomen is short and convex, ovate or elongate-ovate, soft, and generally furnished with a more or less elongated tubercle on each side near the extremity. The wings are very much deflexed at the sides of the body, being almost perpendicular in repose (*fig.* 117. 11.); the fore wings much larger than the posterior, with strong nerves, the subcostal nerve terminating in an elongated stigma, close to which runs another longitudinal nerve, obliquely emitting two or three straight nerves, which run to the hind margin of the wing, the last of which emits one or two branches; the posterior wings have two similar oblique nerves. The legs are long, or very long and slender, formed only for crawling; the tarsi short and 2-jointed, the basal joint being shortest (*fig.* 117. 13.).

The pupa state is active, and resembles the imago, except in possessing rudiments of wings upon the back (*fig.* 117. 15. Pupa Aphis

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Blot. (Myzoxyle) in Mém. Soc. Linn. Calvados.
Bonafous. Aphis Zeæ, Ann. Soc. Ent. France, 1835.
Walker, in Entomol. Mag. No. 14.
Schrank, in Fauna Boica.
Van Heyden, in Museum Seckenbergianum, b. 2. 1837.
Morrem, in Annales Sc. Nat., August 1836. Anat. Aph. Persicæ.
And the general works of *Réaumur, De Geer, Linnæus, Frisch, Curtis, Latreille, Harris* (Exposition of Eng. Ins.).

Pruni), at least in those individuals which ultimately acquire wings; but the family is very anomalous in this respect, many specimens (indeed the majority) never acquiring wings (in which case the pupa is not to be distinguished from the mature larva or imago states), although at certain seasons of the year other individuals of the same species, and of both sexes, obtain fully developed wings.* It is also to be observed, that it is chiefly the females which are produced in this imperfect condition (*fig.* 117. 14. Aphis Rosæ ♀); and when we consider that these individuals are placed in the midst of an ample supply of food both for themselves and their numerous progeny, we cannot be surprised at the non-production of organs which would be comparatively useless; whilst, at the same time, it is not unworthy of remark, that the loss of these organs is accompanied by an extraordinary development of the ovaries: moreover, the suddenness of the maturity of these apterous specimens, dependent upon the object of their production, namely, the checking of vegetation, at such time in the most luxuriant state, seems sufficient to account for the non-production of wings, which would require a greater period of time for their development. The species reside in great societies upon almost every species of plant, of which they suck the juices of the young shoots, leaves, stems, and even roots †, by the assistance of their proboscis, producing in many instances disease in the plant either by greatly weakening it, or by distorting young shoots and leaves; some species raising vesicles, or other gall-like excrescences, in which whole generations of Aphides are residents. The anal tubercles above-mentioned (which are wanting in some species), secrete a saccharine fluid of which ants are very fond; and it is this fluid dropped upon the adjacent leaves, or the extravasated sap flowing from the wounds

* We have already seen in the Orthoptera and Fulgoridæ, that analogous instances occur, in which, however, rudiments of wings (quite unlike those of the true pupa) are acquired by some specimens, whilst others of the same species have them of full size; with the example of the Aphides in view, we can but be surprised that there should be entomologists who doubt the specific and even the generic identity of such individuals. See further observations hereon under Hydrometridæ.

† A writer in the *Entomol. Magazine*, No. 14. p. 337., states that he found whole troops of Aphides in the pips of large sound codling apples! The same writer has published ample details of the injuries committed by Aphis Humuli upon the crops of hops in the same work (No. 3. p. 217.), in which (No. 3. p. 315.) another observer has stated that he has observed the hop-fly produce young actually provided with wings!

caused by the punctures of the insects, which is known under the name of honey-dew.

Each family of plant lice in spring and summer consists of individuals always wingless and of pupæ; all these, however, are females, which produce living young without a previous union with the other sex; and Bonnet, whose researches have removed all doubts upon the subject, has clearly shown that this power is exercised at least through nine generations, which are produced within the space of three months. Whilst Duvau thus obtained eleven generations in seven months, and Kyber even observed that a colony of Aphis Dianthi, brought into a constantly heated room, continued to propagate for four years, with a single impregnation of a female by a male, the young being constantly produced of the female sex. The males, of which some are winged, and others apterous in the same society, are not born until the end of the summer or autumn. They fecundate the last generation, produced by the previously born specimens, consisting of wingless females, which then deposit fecundated eggs, which remain through the winter, and produce young in the spring capable of reproduction without fresh impregnation. It is impossible in this work to enter into the numerous details relative to these insects, which have attracted so much of the attention of naturalists; I must therefore refer more particularly to the memoirs of Bonnet, Réaumur (*Mém.* tom. iii. mém. 9 and 11., and tom. vi. mém. 13.), De Geer (*Mém.* tom. iii. chap. 2 and 3.) Curtis (Observ. on Aphides, in *Trans. Linn. Soc.* vol. vi. *Phil. Trans.* 1771.), Sauvages (on Honey-dew, in *Journ. de Physique*, tom. i., and in his memoirs), as well as the elaborate anatomical researches of Duvau, Dutrochet, and Morrem, above referred to.

Many of the species have the body densely clothed with a white cottony secretion, either in threads or flakes; amongst these may particularly be mentioned the Aphis lanigera, or American blight* as it is termed, which infests the stems of apple trees, sometimes totally destroying them. This species belongs to the genus Lachnus *Illig.* Myzoxyle *Blot*, Eriosoma *Leach*, differing from Aphis in the neuration of the wings, as well as in the want of tubercles at the extremity of the body for the secretion of honey-dew. The antennæ also

* The details of the history of this species are given by Knight and Sir J. Banks in the *Horticult. Trans.*; by Knapp in the *Journal of a Naturalist; Annales Sci. Nat.*, March 1831; D'Arcilly in *Bull. de l'Acad. Ebboicienne du Département de l'Eure*, 1834; Audouin in *Ann. Soc. Ent. France*, tom. v. p. 9. App.

are shorter than in the true Aphides. Other species agreeing with Lachnus lanigerus in the neuration of the wings, have the body naked and the wings in repose carried flat upon the body. I possess three small British species of this group. The very large species which Mr. Haliday has conjectured is identical with Phylloxera, found by Réaumur in the crevices of the oak, and figured by him (*Mém.* tom. iii. pl. 28. f. 5—14.) (Lachnus Quercus *Burmeister*) agrees with these in the wings being carried flat upon the body, and the body destitute of tubercles; but the apterous individuals are naked, and have the promuscis nearly three times as long as the body beneath which it is extended in repose, reaching far beyond its extremity like a tail: from the greatly magnified figures of this instrument given by Réaumur, this instrument appears evidently 4-jointed, the penultimate joint being thickened and the preceding joint being capable of great contraction. The genus Phylloxera *Fonsc.* differs from the preceding in having still fewer nerves in the wings (only three simple ones upon the disc of the wing), although these organs are carried flat upon the back. M. Fonscolombe has sent me a specimen of the species found by him on the Elæa angustifolia (*Ann. Soc. Ent. France*, 1834, p. 224.), with the expression that it certainly belongs to his genus Phylloxera; and M. V. Audouin has supplied me with both sexes of the species found on the oak. The very minute species Vacuna coccinea of Van Heyden (to whom I am indebted for specimens) has the wings similarly veined. The genera Paracletus and Forda *V. H.* (which I also possess from their talented describer), as well as his g. Trama, are founded upon minute species which reside in ants' nests.* (Réaumur also mentions finding Aphides in the nests of these insects.) These insects are all apterous as well as the genera Rhizobius *Burm.*, and Atheroides *Haliday*. The last-named author has published some interesting observations on the habits of the species of Eriosoma in the *Annals of Nat. Hist.*, Nov. 1838†, the majority of the species of which are produced within

* I have above (p. 229. and 234.), alluded to the fondness of ants for the saccharine matter secreted by the Aphides, the place of which seems supplied in tropical climates by the more numerous species of Centrotus and allied genera.

† In Risso's *Hist. Nat. de l'Europe Mérid.*, tom. v. 1826, two new genera are indicated by Leach, namely, Doralis (sp. Pini *Leach*, Dauci *F.*, Ulmi *Le.*, and Rumicis *Le.*) and Phalaris (sp. Cerasi *Le.*, Absinthii *Le.*, Salicis *Le.*, Vitis *Le.*, Populi *Le.*, and Tanaceti *Le.*), without any characters; and a new species of Eriosoma is described under the name of E. Oleæ. I do not know the genus Adelges *Vallot.*

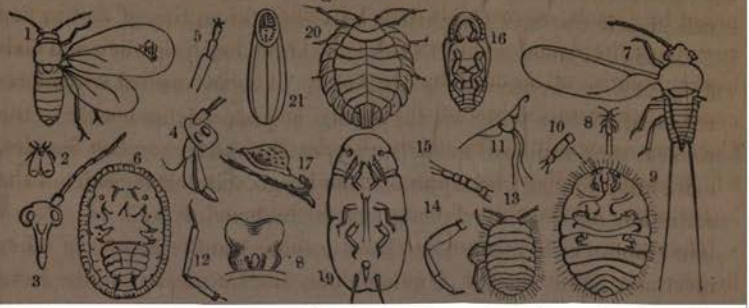
gall-like protuberances on the leaves of trees. The group, as proposed by Leach, corresponds with Latreille's 3d section of Aphis, and comprises the Aphides Gallarum Ulmi, Tremulæ, Xylosthei, and Gallarum Abietis, all figured by De Geer. The last-named species recedes much from the rest of the family, and approaches nearer to the Coccidæ, especially in the nearly globular form of the swollen females, which have very short legs, antennæ, and proboscis, but the setæ of the latter organ are capable of being greatly exserted.

The species of this family are greatly subject to the attacks of other insects; the larvæ of the Hemerobiidæ, the Coccinellæ in the larva and imago states, and the larvæ of various species of Syrphidæ feed upon them, and destroy vast numbers, whilst they are parasitically attacked by numerous minute Hymenoptera, belonging to the families Chalcididæ, Proctotrupidæ, Cynipidæ, and Ichneumonidæ; indeed, one of the genera of the Adscitous Ichneumons is named Aphidius. When an Aphis has received an egg of one of these parasites, it quits its companions, and fastens itself by its ungues to the under side of a leaf, where it swells nearly into a globular form, its skin stretched out and dried up, and in a short time the perfect parasite escapes by a circular hole, the mouth of which sometimes remains like a trap door. Some of the fossorial Hymenoptera also provision their nests with Aphides (see *antè*, p. 195.).

The species require a careful monograph, although descriptions of detached species have been given by Curtis, Walker, Haliday, Blanchard, L. Dufour, Van Heyden, Morrem, Burmeister, and other recent authors.

The family ALEYRODIDÆ consists of the minute species of the genus Aleyrodes (*fig.* 118. 1. A. Chelidonii, magn.; 2. ditto in repose, three times nat. size), distinguished from the Aphidæ by the broad, farinose, and nearly equal-sized wings, and still more by the transformations; and from the Coccidæ by both sexes being furnished with four wings in the perfect state. The head is small (*fig.* 118. 3.), with the eyes bipartite (*fig.* 118. 4.), and not emarginate, as stated by Latreille (*R. An.* tom. v. p. 228.); the antennæ are short and 6-jointed; the promuscis is short, and apparently only 2-jointed, the basal joint longest, and the last short and conical, as is also the labrum, from the extremity of which I extracted two curved setæ in one specimen (*fig.* 118. 4.); the collar is short and transverse; the abdomen neither

Fig. 118.



tubercled, corniculate, nor furnished with long threads at the tip; the four wings are broadly oval, nearly of equal size, covered with a white powder, the anterior having only one strong central nerve*; in repose they are carried nearly horizontally (*fig.* 118. 2.); the legs are short and simple; the tarsi 2-jointed, with two ungues (*fig.* 118. 5.). The transformations of this genus are extremely interesting, agreeing with those of the male Coccus in the scale-like form of the larva, totally unlike the imago (*fig.* 118. 6. after Burmeister), and in the quiescent state of the pupa covered by the skin of the larva. We are indebted to Réaumur for a minute account of the habits of this insect (*Mémoires*, tom. ii. mém. 7. pl. 25.), which feeds, in the larva state, on the leaves of Chelidonium majus, the cabbage, oak, &c., and of which the larvæ and pupæ are devoured by a minute Coleopterous larva, apparently from Réaumur's rough figure of the imago belonging to the Coccinellideous genus Scymnus. The type of the genus, A. Chelidonii, was regarded by Linnæus as a Tinea (Ph. T. proletella, *Syst. Nat.* vol. ii. p. 889.). Réaumur has given a calculation of the number of individuals produced from a single female, showing that in twelve generations the number is at least 200,000 in one year; hence, Linnæus observes, "Parit quotannis 200,000 soboles, dum 12 progenies ponant 12 ova singulæ."† These eggs, varying in number from eight to thirty-six, are arranged around a circular space, covered with white powder, on the undersides of the leaves.

G. N. 1437. Pinicola and Aleyrodes gigantea and dubia of Stephens's *Catalogue* are species of the Neuropterous genus Coniopteryx.

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* Burmeister has incorrectly represented them with nerves similar to those of Coccus. (*Handbuch d. Ent.* vol. ii. t. 2. f. 7.)

† Kirby and Spence, overlooking this calculation, give 200,000 as the number of eggs produced by a single individual. (*Introd. to Ent.* vol. iii. p. 89.)

The section MONOMERA, comprising those species which possess but one joint in the tarsi, terminated by a single unguis (*fig.* 118. 12. leg of C. aceris), is composed of the single family COCCIDÆ*, or scale insects (*fig.* 118. 19. Lecanium Hesperidum ♀), one of the most anomalous tribes of insects with which we are acquainted; and which clearly proves that annulose animals may exist, which become more and more imperfect as they approach the imago state, and which in that state lose all trace of articulations in the body, as well as of articulated limbs (as in the female Cocci and Aspidioti); becoming, in fact, inert and fixed masses of animal matter, motionless and apparently senseless, and which resemble nothing more nearly than the vegetable

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excrescences called galls*: such, at least, is the case with many of the females in the typical groups. The males (*fig.* 118. 7. Pseudoccus *W.*, Cacti *L.*), on the other hand, become winged; but, like certain of the Ephemeridæ, to which they are most analogous, they possess but a pair of wings (carried horizontally in repose, one covering the other, as in *fig.* 118. 8.), and are furnished with two very long anal setæ. The mouth, also, of the males in the perfect state is completely obsolete. The female is, however, furnished with a very short 3-jointed promuscis, arising, as it were, from the breast, emitting several setæ (four, according to my examination, three, according to M. Percheron, *fig.* 118. 11.), capable of being greatly porrected, and inserted into the bark or stems of trees; the antennæ in this sex are short, subsetaceous, inserted before the eyes, generally composed of from eight to eleven joints; and the body is apterous, ovate, globose, or shield-shaped (*fig.* 118. 17. Coccus Cypræola ♀ *Dalm.*, 18. C. gibba ♀ *D.*), often densely clothed with a white, downy, or waxen secretion, variously arranged (*fig.* 118. 20. Dorthesia cataphracta ♀). The males, on the other hand, have the body elongate and depressed (*fig.* 118. 7.), the three parts quite distinct; the head small and rounded; the eyes composed of about ten small grains, placed irregularly, or composite, the ocelli wanting; the antennæ more or less elongated; the thorax wide, with a large scutellum; the abdomen often furnished with an elongated style, as well as the two setæ; others have the abdomen terminated by a long brush of very delicate white filamentous setæ. The wings are large, having a strong subcostal nerve, with a slender discoidal longitudinal nerve, emitting an elongated branch near its base; behind this pair of wings is attached a pair of minute halteres, terminated by a short seta, which represent the hind wings. The tarsi consist of a single joint†, terminated by a single claw.

These insects, which are ordinarily of very small size, are amongst the most injurious to the interests of the horticulturist and arboriculturist: their powers of propagation are excessive; and when they once gain possession of a plant or young tree, its death is almost certain; the minute size of the larva rendering it impossible to extermi-

* In these respects it will at once be perceived that these insects offer a striking analogy with the class Cirrhipeda.

† Dalman fancied he perceived three joints in the tarsi of C. cryptogamus; and I made a similar observation in one of the tarsi of C. aceris; probably the tarsus consists of the three normal joints soldered together.

nate them. Some of the species infest the vine, pine-apple*, and orange trees in hot-houses, where they do great damage; the continued heat and, as Mr. Curtis well suggests, the absence of those parasites which, in the native countries of those plants, keep them in check, rendering their propagation continuous, and not annual, as in the out-of-door species. Sometimes they are so numerous, that I have seen instances in which the entire surface of a branch of an apple tree has been completely covered with them. They are well known to gardeners and others under the name of scale insects and mealy bugs; the former, especially, affixing themselves to the twigs; and the females, by degrees, assuming the appearance of galls, whence they are termed by the French gall insects. The males, in their earliest states, resemble the females; but a period arrives when the individuals of this sex undergo a singular change. At this time, they affix themselves to the plant for a certain period, sufficient to allow them to undergo their transformations; the pupa being inactive, and covered by the skin of the larva, or by an additional pellicle (*fig.* 118. 21. cocoon of C. cryptogamus *Dalm.* ♂).

The following account of the habits of Coccus aceris, communicated by me to Mr. Curtis, from my observations continued through several years, will sufficiently show the habits of the family: —

The males make their appearance in the winged state in May, when the impregnation of the female takes place, in the singular manner described by Réaumur (*Mém.* tom. iv.). The males, on escaping from their singular cocoons, escape backwards, the wings being extended flatly over the head. By the end of June the females have attained their full gravid size; and, on lifting up their bodies, their whole interior, or the entire space between the under surface of the body and the bark of the tree, is occupied by white flowery-like matter, in which the minute young are to be observed, of the size of the smallest dot; the dead body of the parent forming a covering to the young. In this state they are hexapod, antenniferous, active, and furnished with two long anal setæ. By the end of July the young quit the body of their parent, and ascend to the extremity of the young branches; there they affix themselves by their rostrum, gradually increase in size, and lose their anal setæ, as well as their former activity. In this state they remain through the winter, without any diversity of appearance

* See my Observations on two species which infest pine-apples, in *Trans. Ent. Soc.* vol. i. p. 206.

indicative of the sexes; and it is not until the following April that this is first perceived, by the further increased growth of the females, and by the males assuming the pupa state, which is quiescent, with the limbs arranged upon the breast, the fore-legs being directed forwards, a peculiarity not occurring in any other insects. They are much infested by Chalcidideous parasites, several species of which belong to a distinct genus, intermediate between the Encyrti (which are also parasites on this family) and the Eulophi, and which I have described under the name of Coccophagus.

The type of this family (and for which, of course, the generic name Coccus must unquestionably be retained, instead of Illiger's name Lecanium*) is the Coccus Ilicis *Linn.* (Lec. Ilicis *Burm.* vol. ii. p. 71.); a species which lives upon the Quercus or Ilex coccifera (a low bushy shrub, a native of the South of Europe or the Levant), and which was the insect which supplied the famous dye κοκκος of the Greeks, coccum or coccus baphica of the Romans (whence the origin of the terms coccus and coccinum given to cloth dyed with this production; whilst persons wearing this kind of cloth were said by the Romans to be Coccinati (*Mart.* lib. i. epig. 97. lin. 6.); the Chermes or Kermes of the Arabs, Cremesi or Cocchi of the Italians, and Alkermes of the Persians. The females of this interesting species (for specimens

* Burmeister unites into one genus this species and many others having the body of the female greatly swollen without any trace of limbs or articulations; and those which have the body flat, slender, and shield-like (L. Hesperidum, &c.), with the limbs, antennæ, and anal appendages distinct; the latter may retain the name of Lecanium, C. Ilicis that of Coccus, and C. Cacti that of Pseudo-Coccus. Signor Costa, in his memoir published in the third volume of the *Atti del Reale d'Incorr. alle Scienze naturali di Napoli*, and in his subsequent monograph of this family, has made still greater confusion in the nomenclature of these insects, uniting C. Cacti and Polonicus into one genus, first named Diaprostocetus, and then changed to Dactylopius. The genus Chermes *Geoffr.*, including C. Hesperidum, Quercus, Coryli, Rusci, &c., he first named Calimmata, and subsequently Calypticus; and some smaller species analogous to C. cryptogamus *Dalm.*, and C. linearis *Latr.*, *Réaum.* tom. iv. pl. 5. f. 5—7., he has named Diaspis. He has changed many specific names, and regarded many distinct species living upon different plants as varieties of the same species, their differences of colour, form, and texture being "secondo il nutrimento e l'indole degli umori che dalle piante ritrae" — "o per eccessiva ridondanza di umori che la pianta gli somministra, o per la qualità degli stessi!" and he asserts, contrary to Réaumur, De Geer, and all other authors, and as the result of "infinite osservazioni sopra migliaja di casa, e sopra moltissime specie, che il maschio sia simile alla femmina, tranne la sola figura un poco più stretta," &c., considering the male figured by Réaumur in the act of impregnation as a parasitic Ichneumon!

of which, as well as other species of this family, I am indebted to M. Boyer de Fonscolombe of Aix) are of the size of peas, nearly globular, black, shining, and quite smooth, without the slightest traces of articulation.* Its history was first traced by Vallisnieri, Garidel (*Enc. Aix*, p. 250. t. 53.), and Réaumur (*Mém.* tom. iv. mém. 1. pl. 5.). See also Loudon's *Arboretum Britannicum*, p. 1910., where I have given an account of the mode of its culture and collection, and Kirby and Spence, vol. i. p. 320.

Another species, the Coccus Polonicus *Linn.* (G. Porphyrophora *Br.*), was likewise greatly employed in Poland as a dye, whence its name of the scarlet grain of Poland. This species, which is found on the roots of Scleranthus perennis, differs generically from the former in the fleshy texture of the unwieldy female, furnished with short antennæ, and six very short feet, whilst the male has a thick bushy tail and a very broad costa to the fore wings. My friend Burmeister has given me specimens of this and other interesting species in the present family.

A large species, allied to this, found in Armenia, upon the roots of Poa pungens, has been described by Brandt under the name of P. Hamelii (P. Armeniaca *Burm.*). Other European species have been employed in dyeing, as mentioned by Kirby and Spence, vol. i. p. 322.

But the discovery of the cochineal insect of Mexico, Coccus Cacti *Linn.*, has almost superseded the employment of these dyes, and has proved one of the most productive sources of the riches of that country. It is found upon the Cactus cochinellifer, and is collected in such quantities that, according to Humboldt, 800,000 lbs. of cochineal are annually brought to Europe, each pound containing about 70,000 insects; and Dr. Bancroft estimated the annual consumption in England at 150,000 lbs., worth 375,000*l.* This insect, which has been imported by the French into Algiers, and by the Spaniards into Spain †, with apparent success, and which is to be found in many of our hot-houses on the Cacti, belongs to a genus distinct from the preceding species, and which I propose to name Pseudo-Coccus, the male (*fig.* 118. 7.) more nearly resembling that of the true Cocci, whilst the female (*fig.* 118. 9.) is more like that of Porphyrophora, being slightly active, with short antennæ and feet, and enveloped

* Réaumur states that it is covered with a white powder.

† Vincent in *Annal. Sci. Nat.* vol. viii. 1st series; and Theis in *Annal. Soc. Ent. France*, tom. v. p. 1.

in a dense white cottony secretion. My figure 118. 7. represents the male of this species; 8. ditto, with the wings closed, considerably larger than life; 9. the under side of the female magnified; 10. its antenna; 11. its promuscis and seta, after Percheron; 12. the young larva; 13. one of its feet; 14. one of its antennæ; 15. male pupa.

Another valuable material obtained from a species of this family is the Indian product termed lac, which is extensively used in the manufacture of varnishes, sealing-wax, &c.; it is also the basis of the French polish, and is used in making waterproof hats, as well as in dyeing. The perfect insect has not been described with sufficient precision for modern scientific purposes in the memoirs and figures of Drs. Roxburgh and Kerr, above referred to: the female, however, attaches itself to the twigs of various trees, in which state it is called *stick-lac;* when separated, pounded, and the greater part of the colouring matter extracted by water, it is called *seed-lac;* when melted down into cakes, *lump-lac;* and when strained and formed into thin laminæ, *shell-lac.* The species is the Coccus lacca *Kerr,* C. Ficus *Fabr.* Burmeister places it in the same genus with C. Cacti.

A species allied to the cochineal is found upon Tamarix mannifera *Ehr.*, a large tree growing on Mount Sinai, the young shoots of which are covered with the females, which, puncturing them with their proboscis, cause them to discharge a great quantity of a gummy secretion, which quickly hardens and drops from the tree, when it is collected by the natives, who regard it as the real manna of the Israelites. This species, C. manniparus *Ehr.*, is figured in the *Symbolæ Physicæ* by Dr. Klug, to whom I am indebted for specimens.

A remarkable creature, known in the West Indies under the name of the Ground Pearl, and described by Guilding under that of Margarodes Formicarum, from its being chiefly found in ants' nests, is evidently also an insect of this family. (See Latreille in *Ferussac Bulletin,* January 1831, and *Literary Gazette,* June 25. 1831.) The Coccus ceriferus *Fabr.*, described by Anderson in his letters from Madras (1781), and by Pearson in the *Phil. Trans.* 1794, is employed in the production of a white wax, the body of the females being enveloped in a thick and solid coat of wax. (Comp. *antè*, p. 429.) The genus Ceroplastus *Gray* (*Spicel. Zool.*) appears identical with this insect.

Various other remarkable modifications occur amongst these insects: thus, in Aspidiotus, the males have no lateral anal filaments, but the

abdomen is terminated by a long slender tube; in Monophlebus the ♂ antennæ are very long, multi-articulate, and verticillate, and the abdominal segments furnished with long flattened filaments; whilst in Dorthesia (*Cionops* Leach) the antennæ ♂ are very long, but simple, and the abdomen terminated by a thick pencil of very delicate white setæ (frontispiece, Vol. I. *fig.* 8.), and the female (*fig.* 118. 20. D. cataphractus *Sh.*) is covered with elongated flakes of a waxy secretion, which in some exotic species in my collection are nearly an inch long. The females in this genus, as well as in Monophlebus, remain active, with the antennæ and legs distinct. Some of the exotic species are of very large size. I possess several males belonging to the genera Monophlebus and Dorthesia*, the wings of which are nearly an inch in expanse, and a gigantic female from New Holland, given to me by Mr. Hope, which has much the appearance and size of the full-grown larva of Œstrus Bovis.

Order HETEROPTERA.†

(Hemiptera *MacLeay, Stephens;* Hemiptera Heteroptera *Latr.;* Hemimeroptera p. *Clairv.;* Rhyngota p. *Fabr.;* Rhynchota p. *Burm.;* Arthitignathes p. *Spin. Essai Hem. Het.* p. 20.)

Char. Wings four; anterior pair larger than the posterior, lapping partly over each other; basal portion coriaceous, apical part membranous.

* I cannot agree with M. Dufour in considering Dorthesia as belonging to a family distinct from Coccus. (See his *Rech. Anatom. sur les Hémipt.* G. 31.) The males even of my gigantic species are entirely destitute of a mouth; and the nervures of the wings as well as many other characters, and especially the possession of only a pair of wings with halteres, agree with the rest of the Coccidæ.

The numerous observations and drawings which I have made in illustration of this family (which has engaged much of my attention) will form the subject of separate memoirs.

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Body depressed.

Antennæ generally elongated, filiform.

Mouth arising from the anterior and inferior part of the head; promuscidate.

Pupa active, semicomplete (*Metamorphosis* semicomplete *Fab.*).

Having, in the general observations upon the Homoptera, entered into the question of the rank of that and the present group, I shall here merely notice the peculiarities of structure exhibited by these

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insects. The head is generally advanced and broad; the eyes generally placed at the sides of the head, which enter the frontal cavity of the prothorax; the ocelli are occasionally present, and two in number; the antennæ are ordinarily of moderate length, and composed of four or five joints*; they are mostly filiform, but sometimes have the last joint either thickened or very slender. In the aquatic species (where porrected antennæ would be inconvenient) we find these organs greatly reduced in size, and received into cavities on the underside of the head. The mouth is of the promuscidate construction (see *fig.* 119. and 122.); the labium or canal being occasionally greatly elongated, extending beneath the body, and either 3- or 4-jointed.† The four internal delicate setæ represent the mandibles and maxillæ; the maxillary and labial palpi are obsolete‡; the labrum is distinct, triangular, and more or less elongated, closing upon the upper side of the labium at the base, when the setæ enter the labial canal. Savigny has discovered also a minute elongate tongue, trifid in front, between the base of the mandibles and maxillæ, terminated behind by the pharynx in Nepa. In many species which prey upon other insects, as well as in such as reside beneath the bark of trees, the promuscis is very short. The body is ordinarily rounded, oval, or more elongate and depressed. The prothorax is greatly developed (although it never covers the scutellum and wings), imitating in this respect, as well as in the great development of the mesothoracic scutellum, the order Coleoptera: the metathorax is of small extent; on its under side it is furnished with two pores, which secrete the fluid which gives to these insects so unpleasant a scent. The wings, when at rest, are carried horizontally upon the back, the membranous apex of one fore wing lying upon and crossing the same part of the other; the anal area of the fore wings is narrow; the basal part or corium of this pair of wings is often very thick, but occasionally it is sufficiently transparent to permit the nerves with which it is furnished to be perceived; these nerves, both in the corium and apical membrane, vary considerably in number and position in the different

* In Hammatocerus, a genus of Brazilian Reduvii, the second joint is composed of a great number of minute articulations.

† The mode of insertion of the joints of the rostrum or labium necessarily influences the mode of action of this organ. (See Spinola's *Essai*, p. 26—.)

‡ Savigny first discovered two minute oval pieces attached to the third joint of the labium on the upper side in Nepa, and which he considers as the labial palpi, observing that if the sides of the labium were not turned up, these palpi would be at the under side of the joint, as in the Orthoptera. (*Mém. An. Articul.* pl. 4. f. 3.)

genera. The fore wings rise wide apart at the base, in order to leave space for the large scutellum, which is generally triangular, but sometimes so greatly enlarged as to cover the whole of the upper side of the abdomen, leaving only the lateral margins of the fore wings visible. The feet vary considerably in form; in the majority, however, they are simple, and formed for walking; the anterior pair in some is transformed into a pair of organs of prehension, whilst the hind feet in others are greatly dilated and toothed; these limbs are modified in the aquatic species, to fit them for their functions. The tarsi are short, and never composed of more than three joints.

The structure of the mouth of these insects indicates at once that their nutriment consists solely of the juices of plants or animals, which are pumped up the labial canal by the gradual contraction of that organ, the substance from which such juices are derived having been previously wounded by the four sharp internal setæ. By far the greater proportion of these animals are found upon plants from which they derive their nutriment; some, however, feed upon other and weaker insects, found in similar situations. Such are their habits in all their stages, as they continue active, and require food throughout their whole existence. The larvæ are distinguished by the total want of any appearance of the rudiments of wings; whilst, in the pupa, these limbs are to be observed upon the back of the meso- and meta-thorax. The ocelli are only developed in the imago state.

The number of species of this order is very great; the majority, however, are found in tropical countries, in which they are mostly ornamented with a great variety of beautiful colours and markings, often vying in splendour with the most splendid of the beetle tribes. The aquatic species, on the other hand, are uniformly of an obscure black or brown colour. They rarely exceed an inch in length, whilst many are not above a line long: they are, for the most part, found in the winged state at the end of the summer. Almost every terrestrial species in the order emits, on being suddenly alarmed or touched, a peculiar odour, more or less disgusting, and which is so well known in the common bed-bug; but which, in some few species (as in Lygæus Pastinaciæ), assumes a more grateful scent, probably resulting from the nature of the plant on the juices of which it subsists. Others emit the odour of acetic ether, or exhalations similar to that of the majority of the Carabidæ. Fruit, such as raspberries, &c., is occasionally rendered very offensive to the taste by some of the garden species having

previously passed over or sucked its juices. Some species, however, are destitute of this means of defence, and these are chiefly found amongst the predaceous species, with a short curved rostrum. The exhalation of this scent is not, however, continual; for, as Dufour observes, when one of these insects is observed without its being disturbed, no scent is perceived; and if, when suddenly seized, it be plunged into a fluid, innumerable minute bubbles will be observed to issue from two pores between the hind feet, which, on bursting at the surface, immediately emit the scent peculiar to the species. The species of Reduvii, and other carnivorous species, with strong curved beaks, are able to produce, when alarmed, a smart pain, by plunging their rostrum into the flesh, and emitting a drop of fluid discharged from their salivary glands. Others, at the same time, make a creaking noise, by the friction of the fore part of the metathorax within the hollowed base of the prothorax.

A peculiarity occurs in some of these insects, whereof analogous instances have already been noticed among the Orthoptera, Homoptera, Aphidæ, and even in a species of Chalcididæ, namely, the undeveloped state of some specimens in the imago state which are nevertheless as capable of reproduction as others of the same species which have acquired fully developed wings. Thus the bed-bug has never been observed but with the minute rudimental upper wings, somewhat resembling the ordinary wing-cases of pupæ; others, again, as the species of Gerris, Hydrometra, and Velia, are mostly found perfectly apterous, whilst occasionally they are found with full-sized wings. The winged males of Capsus ambulans are stated by Fallen (*Monogr. Cim. Suec.* p. 6.) to be always found coupled with apterous females. Chorosoma miriformis, Prostemma guttula, Pachymerus brevipennis, &c., are generally found with very short wing-covers, but occasionally with full-sized wings.

Two erroneous opinions have been entertained with respect to these undeveloped individuals: first, that they are pupæ, and, consequently, that pupæ are able to reproduce; and second, that they belong to distinct species. Against the first of these opinions, I will only observe that the structure of the real pupæ of such specimens as subsequently attain wings is quite different from that of these *imperfect perfect insects*, as they may be called; and, against the second, I will refer to the analogy offered by the other groups above alluded to, and to the constant discovery of the winged and imperfect individuals in

company, and often in copulation together. The specific identity of the ordinary individuals of Pyrrhoceris apterus (Curtis *B. E.* pl. 465.) having hemelytra destitute of apical membrane, with such as have perfect fore and hind wings, has never been questioned* by writers who continue to assert the specific differences of Velia rivulorum and currens, and form the winged specimens of Hydrometra into a species distinct from the apterous ones.† I must refer, however, to my memoir on this subject (*Annales Soc. Ent. de France*, 1834).

Notwithstanding the great diversity in structure which exists between the terrestrial and aquatic species, it is impossible not to perceive that they unite to form one group, having no immediate connection with the Cicadæ or other primary types of the Homoptera. Mr. MacLeay, indeed, considers the transition to be effected by the Notonectæ and other aquatic species (*Horæ Ent.* p. 376.), which coincide with the Homoptera in the small development of their antennæ and conical rostrum; and with the Heteroptera in having the rostrum frontal, elytra coriaceous, and body generally depressed. Indeed, he even considers it probable that they should be placed in the order Homoptera, from a fancied analogy between Ranatra and Ephemera; a suggestion not likely to be adopted.

I have not followed English entomologists in applying to this order the Linnæan name of Hemiptera, but have preferred employing the sectional name proposed by Latreille for it. My reasons for this are, 1st, the circumstance that these insects are not the types of the Linnæan order; 2d, the name Hemiptera was intended by Linnæus to express the hemielytrate semicoriaceous texture of the fore wings of the Orthoptera and Homoptera; and 3d, the name of Latreille admirably applies to them.

Latreille divided this order into two primary sections (*Gen. Crust., &c.* tom. iii. p. 109.), to which, in his latter works, he applied the names of Geocorisa, or land bugs, and Hydrocorisa, or water bugs

* Even Mr. Curtis figures an undeveloped specimen of this insect, whilst his description is taken from one with fully developed wings and wing-covers.

† Mr. Curtis has recently started the idea that the undeveloped individuals are in a state analogous to the Pseudimago of the Ephemeridæ; a supposition perfectly inconsistent with the circumstance that the pseudimago state consists in the existence of a delicate pellicle entirely enveloping the already fully-developed limbs of the imago, and which it is necessary to slough off before the creature can perform its perfect functions. How can this be applied to the apterous but yet procreative Veliæ, or the subapterous Chorosomæ, Pyrrhoceris, &c.?

and scorpions; including amongst the former a group which he named Ploteres, which reside on the surface of the water. This binary arrangement has been adopted by most subsequent authors, including Burmeister. M. L. Dufour, however, considered the Ploteres as a group of equal rank with the other two sections, and which he accordingly named Amphibicorises; whilst the Marquis Spinola, in his recently published essay upon these insects, proposes five tribes, — Nepides, Hydrocoryzes, Galgulites, Amphibicoryzes, and Geocoryzes. M. Laporte de Castelnau, on the other hand, regarding the habits of these insects as of more importance than the situation in which they exist, has divided them into two groups, Hæmathelges (blood-suckers)* and Anthothelges (flower-suckers); each divisible into aquatic and terrestrial species, characterised by the length or shortness of the rostrum, and the raptorial or simple form of the feet; observing, "Les espèces que la nature a appelées à poursuivre et à chasser une proie vivante sont nécessairement douées d'une intelligence plus étendue; et, par conséquent, sont plus avancées dans l'échelle animale que ces êtres innocents qui doivent rencontrer leur nourriture sur leur route, sans avoir besoin de déployer leur intelligence à la poursuivre." (*Essai Hémipt.* p. 3.) In the present state of our knowledge, however, as M. Spinola has clearly shown (*Essai*, p. 38.), it is impossible to attempt a classification of the order from the nature of the fluid food of the insects; as, for instance, he notices that he had repeatedly observed both Lygæites and Pentatomites sucking the juices of other insects, and points out various other objections to such a mode of distribution. I shall therefore adopt the binary distribution of Latreille. But, as the aquatic species have been regarded as most allied to the Homoptera, they are here placed at the head of the order, which I shall distribute into families, nearly as proposed by Burmeister (whose families appear far more natural than many of his genera); retaining, however, the family termination idæ, founded upon that of the typical genus, namely: —

Section 1. Hydrocorisa, or those which reside in water, divided into two families: Notonectidæ and Nepidæ.

Section 2. Aurocorisa *Westw.* (Geocorisa *Latr.*), or those which breathe the free air, divided into nine families: Galgulidæ, Hy-

* Zoadelges ou Sanguisuges *Dumeril* (*Consid. Gén.* p. 216.), but merely distinguished by the capillary terminal joint of the antennæ

drometridæ, Acanthiidæ, Reduviidæ, Cimicidæ, Tingidæ, Capsidæ, Lygæidæ, Coreidæ, and Scutelleridæ.

The first section, HYDROCORISA, is entirely composed of aquatic species, in which the antennæ are very short, and concealed in cavities beneath the eyes; their legs are more or less fitted for action in the water, being generally ciliated in the posterior pairs, with rarely more than 2-jointed tarsi, whilst the fore legs are short and fold, forming a pair of claws, whereby the insects seize their prey, which consists of other insects. The eyes are often of a very large size. There is considerable diversity in the structure and movements of the species of this section; Notonecta and its allies being admirably formed for swimming, whilst the Nepidæ are very slow in their movements in the water, their legs scarcely serving them as oars; and yet they are equally predaceous with the rest. Living in an element not fitted for respiration, they are compelled to resort to its surface continually to obtain fresh supplies of air; this is easily effected in the Nepidæ and Ranatræ, by the assistance of the two appendages at the extremity of the body, which conduct the air to the two spiracles placed at the sides of the anus, which, from the researches of Dufour, are the only ones the insect possesses, the others, although placed in the ordinary situations, being merely rudimental.* In the Notonectidæ, the extremity of the body is thrust out of the water, whereby a supply of air is introduced beneath the wings and the upper surface of the abdomen, where it is retained by the rows of hairs with which the segments are dorsally furnished, at least in Notonecta. (Dufour, *Anat. Hémipt.* pl. 7. f. 94.) The connection of these insects with the Aurocorisæ is admirably effected by the genera Galgulus, Pelogonus, and especially by means of my genus Aphelocheirus, as subsequently noticed.

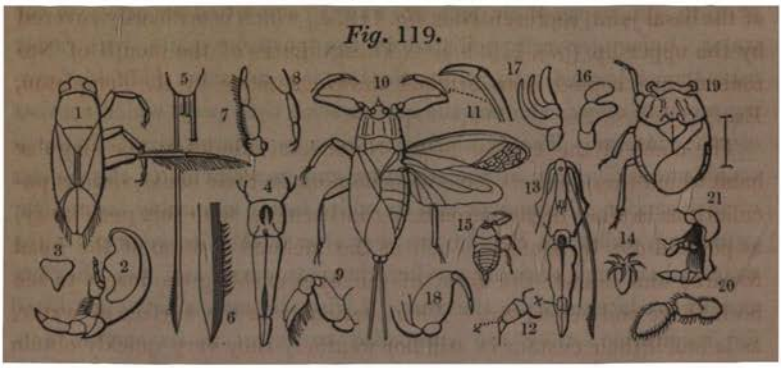
Nearly all the Hydrocorisæ are of a dull brown or obscure black colour.

* See the observations of M. Spinola, referred to beneath, relative to the respiration of the Belostomæ.

The insects of this section have afforded to M. Behn the discovery of the circulation of a fluid through their legs. (See *Ann. Soc. Ent. de France*, 1835. p. 55. App.) This discovery has been denied by M. Dufour, whilst M. Wesmael has confirmed it, explaining Dufour's denial of the fact by stating that he had examined them in cold weather, in which M. Wesmael finds that the phenomenon is not visible. (*Trans. Ent. Soc.* vol. ii. p. 17.)

The species of the first family, NOTONECTIDÆ*, are distinguished by their pre-eminently natatorial habits, their hind pair of legs being greatly elongated and strongly ciliated, forming a pair of oars (generally without ungues), whence these insects have obtained the name of boat-flies (*fig.* 119. 1. Notonecta furcata). Their general form is also much

Fig. 119.



better fitted for swimming than any of the rest, being more boat-shaped, with the head nearly as wide as any other part of the body: although they prey upon other insects, the fore legs are not raptorial, being simply incurved, the anterior tarsi being two-jointed, and terminated by two ungues (*fig.* 119. 8.); the middle legs are also similarly formed to the anterior pair, except that the femora are furnished beneath at the base, in Notonecta, with a pencil of hairs, and near the apex with a short spine, which I have not seen noticed by authors. The elytra are generally deflexed at the sides; the eyes are very large, and bi-emarginate behind (*fig.* 119. 2.); the antennæ (*fig.* 119. 7.) inserted behind and beneath the eyes, 4-jointed, the basal joint inserted at its side, the others diminishing in size. The rostrum (*fig.* 119. 2. and 4.) is short, thick, and apparently only 3-jointed; with this instrument they are enabled to inflict a painful wound, thrusting its extremity into the flesh, into which they also introduce their setaceous maxillæ and

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* BIBLIOGR. REFER. TO THE NOTONECTIDÆ.

Sahlberg. Observ. quæd. Histor. Notonect. imprimis Fennicarum illustrantes. Aboæ, 4to. 1819.

Leach. On the Classif. of the Notonectidæ, Linn. Trans. vol. xii.

Fallen. Hydrocorides et Naucorides Sueciæ, Lund. 1814. 8vo.

Spinola. Essai sur les Hémipt.

And the other general works on the order.

mandibles, the latter of which are armed at the sides with twelve fine recurved teeth: *fig.* 119. 5. represents one of the mandibles entire, and the base of the other, and of the two maxillæ; *fig.* 119. 6. shows the extremity of the mandible more strongly magnified. These organs are introduced into the labium, through an orifice on the upper side of the basal joint, represented in *fig.* 119. 4., which is ordinarily covered by the upper lip (*fig.* 119. 3.). (These figures of the mouth of Notonecta are copied from original drawings made by R. Templeton, Esq.)

The name of the typical genus, Notonecta, alludes to the singular habit which these insects have of swimming on their backs, various peculiarities in their organisation being in harmony with this peculiarity, as pointed out by Dufour; such as the inclined position of the head towards the breast, the form of the eyes enabling the insect to see both above and below, &c. When stationary at the surface of water, as is much their custom in still hot weather, they very quickly obtain intelligence of the approach of danger; when, by a single stroke of their long paddles, which are ordinarily kept stretched at full length, as represented in *fig.* 119. 1., they descend into the water out of sight. Their motions are very quick in their own element, but on the ground they are scarcely able to walk. They are able to fly well, their hind wings being exceedingly delicate.

The larvæ and pupæ differ only from the imago in their smaller size, and in wanting wings; in the pupæ the rudiments of these organs are enclosed in the small flat tubercles on the back; they have the same habits as the imago. Frisch (tom. vi. tab. 13.), De Geer, and Rösel have illustrated the preparatory states of these insects: according to the last named author, the eggs (which are attached to the stems and leaves of aquatic plants, and are of an oval form) are hatched in fifteen days; the young make their appearance at the beginning of the spring, and the parent survives until they have arrived at maturity.

The genus Ploa is remarkably distinguished by the elytra being entirely coriaceous, and uniting together by a straight suture, not overlapping each other in the least.

The genus Corixa is distinguished by several peculiar characters; the prothorax being advanced behind over the scutellum: the body is flattened above. The three pairs of legs are all differently organised, the fore legs being imperfectly prehensile, the tibiæ being short, and the tarsi composed of a single large and ciliated joint (*fig.* 119. 9.).

The middle legs are slender, and armed with remarkably long and slender claws, whilst the hind legs are long, with the two tarsal joints very broad, ciliated, and well adapted for swimming. The same structure exists in the larvæ of this genus, except that I cannot perceive any trace of articulation in the hind tarsi, which consist of a single joint. I have observed great numbers of these insects of different species congregated and huddled together at the surface of the water beneath the ice when frozen; many of them had hold of each other, and they appeared very inactive. The species of this family are widely distributed, and are found in almost all parts of the world. The exotic species require a minute revision, being (as evidently proved by our British species) extremely variable in their markings.

The second family, NEPIDÆ*, has the body depressed (*fig.* 119. 10. Nepa cinerea); the head small, with large lateral eyes; the fore legs strongly raptorial, having the coxæ very long; the thighs dilated, with a notch along the inner edge to receive the tibia, which is curved and united with the tarsus (*fig.* 119. 11.), composed of a single joint, ordinarily without ungues†; the two other pairs of feet are alike in structure, and formed for creeping amongst the roots of aquatic plants, with 2-jointed tarsi, furnished with two ungues. The extremity of the body in the typical species is furnished with two long and slender filaments, the use of which has been noticed above. The

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* BIBLIOGR. REFER. TO THE NEPIDÆ.

The general works of *Spinola, Burmeister, Laporte, Dufour, Zetterstedt, Fallen, Fabricius,* and others upon the entire order.

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† The structure of the fore legs of Ranatra has much puzzled some authors: thus Geoffroy mistook them for antennæ, whilst Mr. Curtis considers that the femur and tibia are united with a strong tooth on the inside at their union, and terminated by a two-jointed tarsus. Analogy with such genera as Mantis, or even Nepa, is sufficient to show the incorrectness of this description, and that the tooth on the under side of the limb indicates that part of the femur which acts in concert with the tip of the raptorial tibia. Latreille and Savigny more philosophically described this "crochet terminal," as "formé de la jambe et du tarse réunies." (*Mém. An. sans Vert.* p. 60.)

antennæ are very short and variable in structure; they appear to be only 3-jointed in the typical species (*fig.* 119. 16. ant. of Ranatra, and see Curtis), whilst in Belostoma (*fig.* 119. 17.) and in Sphærodema (Laporte, *Hémipt.* pl. 52. f. 1.) they are 4-jointed, the middle joints being sometimes greatly developed on one side. The rostrum is a short but robust instrument, the labium being composed of three joints, and having on its front side, at the extremity of the second joint, a pair of oval lobes, first noticed by Savigny in Nepa (*Mém. An. sans Vert.* pl. 4. f. 3 ö, and my *fig.* 119. 13. ×). I have also observed them in several species of Ranatra, &c. (*fig.* 119. 12. ×). *Fig.* 119. 13. further exhibits the place of insertion of the slender mandibles and maxillæ, which are here drawn out of their sheath (the labium), at the orifice represented dark in the basal joint (analogous to that represented in *fig.* 119. 4.), as well as the semicorneous tongue trifid in front, and having the pharyngeal orifice at its base. The description given by L. Dufour (*Rech. Hemipt.* pl. 6. f. 81.) of these internal organs, is quite at variance with the account of Savigny, and all other authors.

These insects are very predaceous, feeding upon other insects, especially the larvæ of Ephemeræ. Their motions are, however, very slow. The females of the typical genus deposit their eggs in the water; they are of an oval form, and surmounted by seven elongated filaments (*fig.* 119. 14.), which serve, whilst the egg is in the oviduct, to form a kind of cup for the reception of the succeeding egg, but which are recurved when the egg is discharged. The eggs of the genus Ranatra are more elongated, and are furnished above with two slender setæ. According to Rösel, they are deposited at random in the water, but Geoffroy states that they are introduced into the stems of aquatic plants, the elongated filaments being alone exposed. M. Dufour has described the eggs deposited by two species of Naucoris, which differ considerably from those of Nepa and Ranatra. The females of some species of Belostomæ carry their eggs upon their backs, arranging them in a single layer with great symmetry. The young insects resemble their parents, except that those which ultimately obtain elongated anal filaments have the body terminated at first by a short point (*fig.* 119. 15. young larva of Nepa). Frisch, De Geer, Rösel, Swammerdam, and Geoffroy have illustrated the transformations of the three genera found in England, whilst M. Dufour has elaborately detailed the anatomy of Nepa and Ranatra (*Ann. Gén. de*

Scienc. Physiq. Brux. tom. vii. and *Recherch. Hemipt.*). The last-named genus is remarkably elongated, with very long and slender feet and anal filaments. Like the rest of the family, it is able, when disposed, to leave the water and take wing. I have seen one descend into a pond, when it had the greatest difficulty to immerge itself, owing to the dryness of the anal filaments; at the same time I noticed that it did not move its four hind legs in concert. The other British genus Naucoris is especially interesting in the arrangement of the order, from its more perfect powers of swimming, the four hind legs being well fitted for this action; in this respect, as well as in the breadth of the head, approaching the Notonectidæ; but the fore legs(*fig.* 119. 18.) are more perfectly raptorial than in any of the other Nepidæ, the femora being greatly dilated. In the Crochard edition of the *Règne Animal* (*Ins.* pl. 93. f. 5. c), this leg is described and figured as wanting the anterior tarsus, but this part clearly exists; the rostrum is short (*fig.* 120. 1.). The genus Belostoma comprises some of the most gigantic species of this order, being three inches long. These are peculiar to the waters of the tropics: their ovate depressed form, and the more natatorial structure of the hind feet, fits them better for swimming than the Nepæ and Ranatræ. The fore feet of the large species are peculiar, having the tarsi distinctly 2-jointed, but quite incorporated with the extremity of the tibiæ, and terminated by a long, slender, and acute unguis.* In some of the smaller species (G. Diplonychus *Lap.*), there are two short ungues in the anterior tarsi, which are more distinct, and they are also furnished with a short basal (3d) joint easily visible from beneath.

The second section of the order has been named GEOCORISA by Latreille, the greater number of the species being terrestrial; some, however, are found upon the surface of water; and hence these, although closely allied in general structure to the other Geocorisa, have, on that account, been separated by L. Dufour into a distinct

* In the larva the fore feet are terminated by two ungues. M. Spinola also states that the males of the large Brasilian species B. grandis have also two ungues. He also asserts that the male Belostomæ and both sexes of Sphærodema have the ordinary organs of respiration; whereas in the female Belostomæ the spiracles of the abdomen (except the last pair) are obsolete; and further, that the two anal appendages of this genus are in no wise employed in the act of respiration. (*Rev. Zool. Soc. Cuvierr.* 1839, p. 112.) It is on this account that Spinola has separated the Nepides as a distinct primary tribe of the order from the rest of the Hydrocorizes.

section, Amphibicorisa, an inappropriate name, because the species never reside *in* the water. In order to retain the section in its extent so well characterised by Latreille, and, at the same time, to avoid his misnomer, I have proposed for them the name of AUROCORISA, or such as live in the open air. From the Hydrocorisa they are ordinarily distinguished by the greater length of the antennæ, which are not minute, and concealed in cavities beneath the eyes; and by the legs, fitted for running or walking, and not for swimming. At the same time, however, as if to show the impossibility of confining nature within the limits of our arrangements, the Galgulidæ (which have hitherto been arranged with the Hydrocorisa, but which differ therefrom in not residing in the water), as well as the genus Pelogonas, have the antennæ minute, and concealed in cavities beneath the eyes; whilst Aphelocheirus still more nearly approximates to Naucoris, in being truly aquatic, whilst the elongated structure of its rostrum proves its decided affinity to Pelogonus and Acanthia. It is always amongst these osculant but highly interesting groups that the systematist is baffled.

The third family, GALGULIDÆ, or the first of this section (*fig.* 119. 19. Galgulus oculatus, North America), consists of very few species, distinguished by the cursorial structure of the hind legs; the short, broad, and depressed form of the body; broad head, with pedunculated eyes; short rostrum (*fig.* 119. 21. head sideways), and small antennæ, inserted in a cavity beneath the eyes, and composed of four joints (*fig.* 119. 20.), the third of which is small, and has been overlooked by some authors; the fore legs are more or less raptorial, consisting of a broad or very broad femur, slender tibia, and a tarsus consisting, in Galgulus, of a single joint furnished with two long slender ungues, but formed, in Mononyx, into a slender curved hook without ungues; the fore feet, in this genus, being more pre-eminently raptorial than in Galgulus; the other tarsi are 2-jointed, with two ungues; the two ocelli are minute, and placed on the front of the face, between the eyes.

The form of the fore feet and the pedunculated eyes clearly show that the insects of this family are predatory, feeding upon other insects; whilst the presence of ocelli, and the structure of the hind legs, indicates them to be cursorial, and not natatorial; it is, accordingly, upon the margin of water that these insects are stated to

reside, burying themselves in the sand, especially in the larva state. Fabricius, however, states that Mononyx raptoria "habitat *in* Americæ meridionalis *aquis*." (*Syst. Rh.* p. 111.) M. Desjardin has, however, described the habits of a Mauritian species, which is found under stones and wet leaves on the coast of Mauritius.* (*Ann. Soc. Ent. France*, 1837, p. 240.)

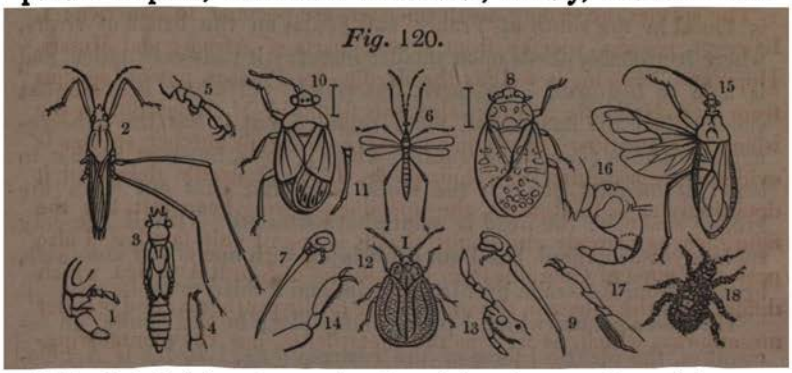
The species, according to Burmeister, are peculiar to America; I, however, possess species from several parts of Africa; and Messrs. Hope and Darwin, as well as the Jardin des Plantes, possess species from New Holland; another, also, was found by M. Desjardin in the island of Mauritius. In Calliaud's work on Egypt another species is evidently represented in vol. ii. pl. 58. f. 28. Latreille described it doubtingly as a Pentatoma, the specimen having been lost, but the figure leaves scarcely any doubt that it is one of this family. I also possess a pupa of Galgulus from the interior of South America, which differs from the imago in the smaller size of the prothorax, and broader mesothorax, which, as well as the metathorax, has rudimental wing-covers; the tarsi of the hind legs appear only 1-jointed, like the fore tarsi, with two ungues; the eyes are very prominent, and the ocelli wanting; the larva of Mononyx, described by Serville and St. Fargeau (*Enc. Méth.* tom. x. p. 271.), differs (like the imago) in the less prominent eyes; the anterior tibia and tarsus are united into a hook, and the second abdominal segment is armed with a central recurved spine.

The family is especially interesting with respect to the classification of the Heteroptera; agreeing with the typical Nepidæ in the prominent eyes, short rostrum, raptorial fore legs, and slender hind legs; but the evidently cursorial habits of the insects on the margin of water induces me to remove this family from the Hydrocorisa to the Aurocorisa. Burmeister adds the genus Pelogonus to this family; but the structure of its rostrum indicates a closer relation with Acanthia. The present situation of the family, however, interrupts the passage from Naucoris to Acanthia, so beautifully effected by means of the genera Aphelocheirus and Pelogonus.

* This species differs from all the others in having the elytra united together in a straight suture, and soldered to the scutellum without any wings. Messrs. Brullé and Serville in a supplemental notice, consider the elytra as wanting, and the insect as covered by a large scutellum. Having carefully examined Desjardin's specimens in the collection at the Jardin des Plantes, I am convinced of the correctness of his description.

The fourth family, ACANTHIIDÆ, consists also of but few species, of small size, but interesting structure, distinguished by their large eyes, oval depressed bodies, long and simple legs, and long and slender rostrum, the second joint of which is greatly elongated and straight. This character exists in three genera, which, in several other important respects, differ from each other, namely, Acanthia *Latr.*

Fig. 120.



(Salda *Fabr.*) (*fig.* 120. 10. A. saltatoria), Pelogonus *Latr.* (*fig.* 120. 8. Pelogonus marginatus), and Aphelocheirus *Westw.* (vol. i. frontisp. fig. 7.). In the first of these genera, for which I retain the name of Acanthia (which the Germans give to the bed-bug, which ought surely, however, to retain the generic name of Cimex), the antennæ are nearly half the length of the body, the terminal joints not thinner than the preceding (*fig.* 120. 10.); the legs are formed for running; the ocelli are present between the eyes; and the rostrum is elongated (*fig.* 120. 11.). These are minute insects, found on the borders of rivers and other water, as well as the sea-shore; and possessing great activity, both in running and flying: they also leap tolerably well. The tarsi are 3-jointed, the basal joint being concealed on the upper side; the ungues are long, and without pulvilli. I possess the pupa of A. saltatoria, which differs from the imago in the want of ocelli, in having the rudiments of the fore wings half the length of the abdomen; those of the hind wings are only slightly visible between the other two.

The genus Pelogonus (*fig.* 120. 8.) is another of the links immediately connecting the two sections of the order, agreeing with the Galgulidæ in general characters, except in having the fore feet simple; whilst it agrees with Acanthia in the peculiar structure of its rostrum (*fig.* 120. 9.), but differs in the shortness of its antennæ.

Burmeister has removed it, however, far from Acanthia, and placed it in the family Galgulidæ. M. Léon Dufour, however, observes that, in regard to their external and internal structure and economy, Acanthia, Pelogonus, and Leptopus ought to form a distinct family, whose natural situation is at the end of the Geocorisa, and to which Galgulus should perhaps be united. P. marginatus, the type of the genus, is found in the south of France and Spain, on the banks of rivers, where it probably feeds upon smaller insects; it runs very quick, and is able to leap well. Its larva, described by Dufour, is somewhat smaller than the imago, and more rounded, but it has the same general structure (except in wanting wings); it is, however, unable to leap: it inhabits beneath the moist sand, but runs out when the ground is shook; the head is somewhat rostrated. This is the only species yet described, but I am acquainted with one of the same size, brought from Australia by Mr. Darwin, and a third twice its size.

The other genus, which I provisionally place in this family, on account of the identical form of the rostrum (*fig.* 120. 7.), is Aphelocheirus *Westw.*, founded upon Naucoris æstivalis *Fab.* (vol. i. frontisp. fig. 7.), the peculiar structure of which has been overlooked by authors, who continue to cite it as a species of Naucoris, from which it differs in having simple fore feet, and in the great length and slenderness of the rostrum. In respect, however, to its aquatic habits and natatorial hind feet, it assimilates to that genus; thus forming a beautiful link between it and Pelogonus. I have had the good fortune to capture this interesting insect *in* the river Evenlode, near Ensham, Oxon; it swims very fast, using its hind legs chiefly, but crawls very slowly, using its four fore feet; its antennæ are much longer than in the other water species; all the tarsi are slender and 2-jointed, with two slender ungues. My British specimens have but short, rudimental, oval hemelytra, like those of the bed bug; but I possess one of Bosc's original specimens, described by Fabricius, not quite so large as the others, in which the wings are fully developed. I do not, however, on that account, regard the former either as pupæ or distinct species, but as undeveloped specimens in the imago state. (See my memoir on this genus in Loudon's *Mag. Nat. Hist.* vol. vi. p. 228.)

Another remarkable and interesting genus, Leptopus *Latr.*, considered by Latreille, Burmeister, and others as alone forming, with Acanthia, a separate family, may here be noticed. Closely allied to that genus, in the general form of the body, very prominent eyes, long slender feet, it is distinguished by the greater length and slenderness

of the antennæ, by the long and fine spines with which the fore legs are armed, and especially by the very short and curved rostrum, also spined, which appears to connect this genus with the Reduviidæ. There are three species, found in France and Spain, described by Dufour (*Annales Soc. Ent. de France*, tom. ii. and iii.); I likewise possess a new species, discovered by M. Van Heyden on the top of a mountain near Ems, under stones in dry places; as well as another undescribed species from the banks of the Nile, given to me by Dr. Klug. (See the Crochard ed. *Règne An.* pl. 93. for excellent figures of several of these genera.)

The fifth family, HYDROMETRIDÆ*, is composed of species differing in their habits from all the other Heteroptera; being constantly found upon the surface of standing or running waters, on which they possess the power of progression as completely as any of the others.† The body is long, narrow, and generally clothed on the under side with a fine coating of plush, evidently serviceable in repelling the action of the water (*fig.* 120. 6. Hydrometra Stagnorum; 2. Gerris Paludum); the head generally as broad as the thorax; the antennæ long, slender, and 4-jointed, the terminal joints not being thinner than the preceding, and

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* BIBLIOGR. REFER. TO THE HYDROMETRIDÆ.

Schummel. Versuch. der Ploteres. 8vo. Bresl. 1832.

Eschscholtz. Entomographien. (Halobates.)

Dufour, in Annales Soc. Ent. de France, vol. ii.; and in his Récherch. Anat. Hemipt.

Westwood, in Ann. Soc. Ent. France, 1834.

And the general works of *Burmeister, Spinola, Curtis, Dufour, Hahn, Guérin. Fabricius, &c.*

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† Hence Latreille formed them into a distinct section named Ploteres (although their motion is not that of swimming), in the Genera Crustaceorum, &c., which name L. Dufour changed to Amphibicorisa, a name surely inapplicable, the species living neither *on* the land, or *in* the water. Burmeister names them Hydrodromici, altering the names of Gerris and Hydrometra, overlooking the fact that Cimex lacustris was given by Fabricius as the real type of his Gerris (*Ent. Syst.* tom. iv. p. 187. 1794), and that C. Stagnorum is Latreille's type of his genus Hydrometra (*Précis*, p. 86. 1796), which last Fabricius subsequently (in *Syst. Rhyng.*) misapplied to the genus he had previously named Gerris, which name he then gave to totally different insects.

having occasionally a minute rudimental joint at their base; the rostrum is of moderate length, the third (or the penultimate) joint being considerably longer than the others; the upper lip is distinct, long, and much narrowed in its apical part; the legs vary considerably in their structure in the different genera; the anterior, however, are in none raptorial, although their peculiar position in Gerris (*fig.* 120. 2. Gerris Paludum) renders them evidently serviceable in retaining their prey; the tarsi are short and 2-jointed; occasionally, however, 3-jointed, as in the fore tarsi of Velia (*fig.* 120. 5.), in which certain minute membranous retractile lobes have been observed by M. Doyère (*Ann. Soc. Ent. de France*, 1837, and Crochard ed. *R. An.* pl. 92.). The ungues are often inserted in a notch before the tip of the tarsus.

Of these insects Gerris (*fig.* 120. 2.) is by far the most active, the species skimming along the surface of the water with great velocity, and turning about with the greatest ease; for this purpose, the form of their bodies, nearly resembling that of a London wherry, is admirably fitted. Mr. Curtis observes, that "these insects, by rowing with their posterior feet, glide over the water:" but this is inaccurate; the hind feet act conjointly as a rudder, whilst the longer middle feet, placed at the middle of the sides of the body, are used somewhat as oars*: they are not, however, dipped into, but merely brush along the surface of the water. Velia has a similar, although slower action, having much shorter feet; but Hydrometra (*fig.* 120. 6.) merely creeps slowly upon the surface, the body of the insect being considerably elevated; hence it is mostly found amongst the low plants growing out of and at the side of water.

Many of these insects are subject to a remarkable diversity in their development in the imago state; many of them are found in a completely apterous state, although in all other respects they are fully developed and full-sized, and are often found coupled together in this state. By Geoffroy, who appears first to have noticed this fact, they were considered as *larvæ*, possessing procreative powers; whilst Kirby and Spence regarded them as pupæ (*Introd. to Ent.* vol. iv. p. 570. "Inter *pupas* Orthopterorum et Hemipterorum coitus interdum locum habet, quod maturiorem organizationem in his analogis quam in aliis insectis probat."). Others, again (De Geer, Dufour, Curtis, &c.),

* In the singular Gerris laticauda *Hardw.* (*Linn. Trans.* vol. xiv. pl. 6. fig. 1, 2.; and *Griffith, An. K. Ins.* pl. 93. fig. 2.), the middle femora have a dense coating of hairs, and in Velia the middle tibiæ are more sparingly furnished in the same manner, thus offering a broader surface for opposing action.

considering the full-grown size of these wingless individuals, adopted the opinion that they were species distinct from such as acquired wings, as the winged and apterous specimens of Velia *, &c. It appears to me, however, that, from causes of which we are ignorant, numerous individuals of many of the species of these tribes are subjected to an inferior kind of development in the imago state, which does not allow the acquirement of wings; which, however, in certain cases, acquire their full size. Hence, the same principle must be applied to the completely apterous individuals of Velia or Hydrometra as to the half-winged individuals of Pyrrhocoris apterus or Prostemma guttula, which no one regards otherwise than as specifically identical with the full-winged specimens of the same species. Hence, I consider that the apterous specimens of Hydrometra stagnorum, those with very short elytra (as figured in the Crochard ed. *R. An.* pl. 92. f. 6.), and those with full-sized wings and wing-covers (Curtis, pl. 32. fig. *sup.*, and my *fig.* 120. 6.†), are all in the imago state, although some are more perfect than others. Another circumstance confirming this opinion is the ordinary condition of the pupa state of such individuals as acquire wings: whereas the pupa state of the ultimately wingless specimens is necessarily destitute of rudimental wing-cases; hence we cannot consider these wingless insects as stopped in their development, or, in other words, as imagines, left enveloped in the skin of the pupa ‡, but must be compelled to regard them as imagines with peculiar characters of their own, somewhat analogous to the neuters, or undeveloped females of the bees; but yet more perfect than that kind of imago, being capable of reproduction.§

The very young larva of Gerris ‖ differs materially from the adult specimens in form, being very much shorter and broader, the hind legs appearing inserted near the extremity of the body, owing to the

* See *Mag. Nat. Hist.* 1st series, No. 18., on V. rivulorum and V. currens, regarded as distinct species.

† Scopoli's other species having the "abdomen lineis elevatis longitudinaliter striatum" is probably a full-winged specimen, the longitudinal veins of the wings being mistaken for abdominal ridges.

‡ Hence the inutility of Mr. Curtis's suggestion to cover a number of the wingless Veliæ with a gauze covering, in order to see whether they would not ultimately obtain wings.

§ In my memoir on these insects, in the *Annales de la Soc. Entomol. de France*, I have entered more fully into this question.

‖ Gilbert White (*Nat. Hist. Selborne,*) believed these insects to be viviparous.

great development of the thorax and the rudimental state of the abdomen* (De Geer, tom. iii. t. 16. f. 16.). In the full-grown larva of Velia, the abdomen is greatly enlarged in size, being still broader in proportion than in the imago; the thoracic segments are still separate and visible (Schummel, *Ploteres*, t. 2. f. 2. b, c, d.). In the pupa of Gerris, the prothorax is short, the mesothorax large, with a large scutellum, partially grooved down the middle, and two separate†, large, and very shining black wing-cases, half covering the abdomen (*fig.* 120. 3.); and the tarsi have only one joint. The wingless imagines of Velia and Gerris have the prothorax large, but truncate behind, exposing the other thoracic segments; but, in the winged ones, the prothorax is produced behind into a scutellum-like process.

A remarkable and minute species of this family, found in France, was first described, under the name of Velia pygmæa, by Dufour, who observed only two or three with wings out of some hundreds of specimens. The Rev. L. Guilding discovered another species, most closely allied to this, in St. Vincent's, which I described under the name of Microvelia pulchella, as it differed generically in some respects from Velia. This species must also have been most abundant, as Mr. Hope (who possesses Mr. Guilding's specimens) has very great numbers; but almost all are winged. Subsequently Dr. Burmeister hypercritically changed my generic name to Hydrœssa, altered L. Dufour's specific name, and inconsiderately gave my West Indian species, and Dufour's French one, as synonymous. Mr. Curtis, in 1838, figured L. Dufour's species (which I first discovered in England, fifteen years ago, amongst aquatic plants on Wandsworth Common, and at the roots of grass in Battersea Fields), under the name of Hydrœssa pygmæa, from specimens then recently found by Mr. Haliday in Ireland. The wingless specimens of this little group have much the appearance of minute larvæ of Veliæ; but the abdomen is fully developed.

Hebrus pusillus *Wlk.*‡, another minute species, found amongst aquatic plants, and which I have also illustrated in the same memoir, appears to form a connecting link between these insects and

* It is on this account that I am inclined to consider the oceanic species, figured by Eschscholtz, as forming his genus Halobates, as not arrived at the imago state One species of this genus is described by Templeton (*Trans. Ent. Soc.* vol. i.), captured midway between Africa and America.

† Schummel's tab. 3. fig. 3. is incorrect in this respect.

‡ Dr. Burmeister has misapplied this specific name, giving it to a North American species, and another name to our species which he had found near Berlin.

some of the more minute Lygæidæ; possessing ocelli, apical ungues, and a distinct scutellum in the winged state.

The situation of this family in a natural arrangement of the Heteroptera is difficult to be determined. In the *Règne Animal*, and by Burmeister and Dufour, they are introduced between the Hydrocorisæ and the Acanthiidæ; thus unnaturally interrupting the passage from Acanthia and Pelogonus to Aphelocheirus and Naucoris.* The mere circumstance of their walking upon the surface of water appears to have been considered as sufficient to prove their relationship with truly aquatic species, with which, in structure, they present but little agreement. By placing them in this situation, I retain all the water groups together; but this is done at the expense of the relation between Acanthia, Leptopus, Macropthalmus, and the other true Reduviidæ. Laporte places them at the head of his Anthothelges; but their food certainly consists of other insects.

The sixth family REDUVIIDÆ † (*fig.* 120. 15. Reduvius personatus) is of great extent, and consists of terrestrial species, well distinguished by the short, thick, naked, and curved rostrum, the labrum exserted (*fig.* 120. 16. head of R. pers.); the head narrowed behind into a more or less elongated neck, and furnished with two large prominent eyes and two ocelli; the antennæ are of moderate or considerable length, with the terminal joints very slender ‡; the prothorax is often spined as well as more or less completely divided into two parts; the legs are long, and fitted for running; the tarsi 3-jointed and simple, the basal joint being very short; the anterior

* Latreille, in the *Gen. Crust, &c.*, avoided this, by placing them between the Reduviidæ and Cimicidæ, which are, however, closely allied together.

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† BIBLIOGR. REFER. TO THE REDUVIIDÆ.

Burmeister, in Trans. Ent. Soc. Lond. v. ii. pl. xi. (Myocoris).

Serville, in Ann. Sci. Nat. t. xxiii. (Pierates). — Ditto, in Guérin, Mag. de Zoologie, and in Encyclop. Méthod.

Heineken, in Zool. Journ. vol. v. (Cerascopus).

Gray, on Ptilocerus, in his Zool. Miscell., No. 1.

And the general works of *Klug*, *Hahn*, *Burmeister*, *Laporte*, *Boisduval*, *Perty*, *Palisot Beauvois*, *Say*, *Griffith* (An. K.), *Coquebert*, *Guérin* (Voyages), *&c. &c.*

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‡ In some species, some of the joints have a minute rudimental joint at the base.

tibiæ, in some species, are terminated on the inside by an oblique, hollow, fleshy lobe or pulvillus (*fig.* 120. 17.), serving, apparently, to assist the raptorial habits of the species, which are more pre-eminently insectivorous than any of the other terrestrial species; the membranous part of the fore-wings often extends nearly to the base of the wings, and the veins are few and large. *

These insects vary greatly in size as well as in general appearance, colouring, &c. In many the sides of the abdomen are greatly dilated and thin, not being covered by the wings: in others, the body is short and thick; whilst in some, Zelus, &c., it is very slender: this is much more especially the case in the genera Ploiaria † and Emesa, which last consists of species resembling the thinnest bits of stick fastened together; these two genera are further distinguished by the perfectly raptorial structure of the very small fore-legs, with the coxæ greatly elongated, like those of the Mantidæ. In their motions they resemble the Tipulæ, balancing themselves on their long legs.

The species are chiefly exotic, very few being natives of our climate: they generally want the power of emitting a strong scent; but the wounds they are able to make with their proboscis are very acute: this is more especially the case with the large exotic species, one of which, "of the size of our cockchaffer," greatly annoys the inhabitants of Chili by night. It is called Benchuca. Another large species, Arilus (Prionotus *Latr.*) serratus, or the wheel bug (so named in the West Indies, from the singular prothorax circularly elevated, and toothed like a cog-wheel), is stated by Kirby and Spence (*Intr.* i. 110.) on the authority of Major General Davies, to be able to communicate a sharp electric shock. Many are found upon flowers and trees, and some inhabit our houses; amongst the latter may especially be mentioned Reduvius personatus (*fig.* 120. 15.), a black insect, which is asserted to feed upon the bed-bug, the larva (*fig.* 120. 18.) and pupa of which have the instinct to envelope themselves in a thick coating of particles of dust (De Geer, *Mém.* iii. pl. 15., and Geoffroy, i. pl. 9. f. 3 h), and so completely do they

* Dufour, *Rech. Anat. Hemipt.* g. 12. sp. 2. states, that in Red. marginatus the structure of the Hemelytra has been overlooked, and that the membrane is entirely wanting; but this is not the case: it is the corium that is nearly obsolete: this is proved by other species in the family, as Opistoplatys Australasiæ (Westwood in *Z. Jl.*), Holoptilus Lemur *Westwood, &c.*

† In the 6th vol. of the *Turin Transactions* is contained a memoir on the circulation observed in this insect.

exercise this habit, that a specimen shut up by M. Brullé, and which had undergone one of its moultings during its imprisonment, divested its old skin of its coat of dust, in order to re-cover itself therewith. (*Hist. Nat. Ins.* tom. ix. p. 307.) Mr. Bird has observed, that the imago flies into lighted rooms at night. (*Ent. Mag.* ii. 41.) Like most other rapacious species, it is enabled to undergo a long fast. The larva of Ploiaria possesses similar habits. The pupa is figured by De Geer, *Mém.* vol. iii. t. 17. Some exotic species allied to Ploiaria (g. Cerascopus *Heineken*, Emesodema *Spinola*) never acquire any rudiments of wings; they are domestic insects, and are almost invariably found after dusk, according to the former author, who has published a very interesting notice of the habits of C. marginatus as above referred to. Its motions are very slow, although it is so insectivorous that a female killed and sucked a companion of her own sex, her own mate, and, after only a few days' fast, her own young, and sucked her own eggs! The young differs only in being more linear and smaller.

Some of the species, especially Pierates stridulus, make a loud noise by the friction of the neck within the prothoracic cavity. (*Ann. Soc. Ent. France*, 1837, p. 66.)

Two British species of this family, Prostemma guttula *Fabr.* (brachelytrum *Duf.*) and Coranus subapterus *Curt.*, *De Geer* (Collicoris griseus *Hahn*, Oncocephalus g. *Spin.*? Red. pedestris *Wolff*, but certainly not Aptus apterus *Hahn*, as quoted by Burmeister), are interesting on account of their being generally found in an undeveloped imago state; the latter being either entirely apterous, or with the fore wings rudimental, although occasionally met with, having the four wings completely developed. "Je pense (observes Spinola, *Essai*, p. 96.) que la présence des ailes, et leur développement dépendent du climat;" and, in speaking of Oncocephalus griseus he says, "L'influence du climat septentrional parait avoir arrêté le développement des organes du vol." (*Ibid.* p. 103.) It will be seen by referring to pages 158 and 431. *antè*, that I have noticed that it is, *especially in hot seasons*, that certain species acquire full-sized wings, whilst the circumstance noticed respecting the ordinary occurrence of winged specimens of Microvelia in the West Indies (p. 470.) is confirmatory of the same opinion.

Some very singular modifications of form occur amongst the exotic species. In some (Petalocheirus *Pal. B.*) the fore tibiæ are greatly dilated; in others, Notocyrtus *Hoffm*, Saccoderes *Spinola*, Red. dorsalis *Gr.* (*An. K.* pl. 91.), R. inflatus and vesiculosus *Perty* (*Del.* pl. 34.), and Arilus tuberculatus (*Griff. An. K.* pl. 91.), the prothorax is vesi-

cularly elevated and curiously tubercled, extending considerably over the back. In Diaspidius Scapha *Westw.* (in *Drury*, 2d. edit.) the prothorax is flatter, and extends behind in the place of a scutellum. The curious forms of Arilus serratus* (and several allied species) and Emesa† have been already noticed. In Hammatocerus (C. perspicillaris *Drury*), the second joint of the antennæ consists of a number of minute articulations quite unlike any other insect in the whole order.‡ In my exotic genus, Enicocephalus, consisting of minute species, the head appears to consist of two distinct heads, the posterior being globular, and furnished with the ocelli; and the prothorax is divided into three distinct transverse lobes, so that the front of the body seems to consist of pieces improperly united together; the structure of the fore legs is also remarkable. (See my *Monogr.* on this g. in *Trans. Ent. Soc.* vol. ii. p. 23. pl. 2. f. 8.) Holoptilus *Serville* (Ptilocerus *Gray*) is remarkable for the brushes of very long hair upon the antennæ and legs. I have also presented a monograph of this anomalous genus to the Entomol. Soc. The larva of H. Lemur *W.* (Australia) exhibits the curious structure of the antennæ and hind legs of the imago.

The seventh family, CIMICIDÆ §, is here restricted to the genus comprising the bed-bug (*fig.* 121. 1.), for which the name of Cimex

* I possess the pupa of this species, which has the back of the prothorax merely slightly elevated without any serration.

† Mr. M'Leay has informed me that he found the large Emesa filum in Cuba under stones.

Heineken (*Zool. Journ.*, No. 16. p. 426.) has given the details of an interesting experiment he made with a species of Reduvius inhabiting Madeira relative to the reproduction of mutilated limbs. On the 8th of August he divided both antennæ of a pupa through the basal joint: — "Sept. 4. Reproduced, at the same time, moulting into a perfect insect. They are of unequal lengths, thicker and shorter than the original ones, and, as far as I can ascertain, having only three instead of four joints.—Oct. 10. Died from want of proper food, the antennæ still unequal and imperfect. It had not moulted again!"

‡ The same character is visible in a pupa of this insect, collected by Mr. Doubleday in America.

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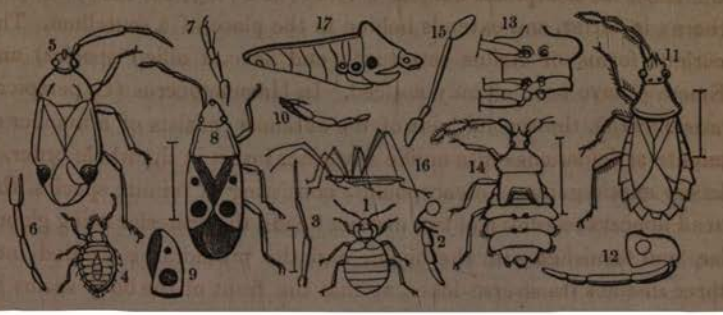
§ BIBLIOGR. REFER. TO THE CIMICIDÆ.

Southall. A Treatise on Bugs. 8vo. Lond. 1730.; Hamb. 1737.; Berl. 1742. n. ed. 1793.

Carlson, in Vetensk Acad. Handl. 1789. (Cimex lectularius).

Jenyns, in Annals of Nat. Hist., No. 17. June 1839. (3 n. sp. Cimex)

Fig. 121.



ought to be retained, although the Germans, following Fabricius, give it under the generic name of Acanthia. It has been united by Latreille, Burmeister, and others, with the Tingidæ, but the longer rostrum (*fig.* 120. 2.) and the slenderness of the apical joints of the antennæ (*fig.* 120. 3.) at once separate it from them; the latter character pointing out its relation with Reduvius, with which Dufour also states that it agrees in internal structure. The antennæ are 4-jointed; the labium 3-jointed, the basal joint being the longest; the thorax is sublunate, not transversely divided, as in the Reduviidæ; the abdomen very much depressed, and more or less orbicular; the wings are reduced to a pair of short transverse scale-like pieces; the legs are moderately long and slender; the tarsi 3-jointed.* The habits of the typical species Cimex lectularius *Linn.*, are too well known to require description. Its introduction into this country has been the subject of discussion. It was well known to Pliny (*Hist. N.* 29. 17.), Dioscorides, Aristophanes, and Aristotle (*Hist. An. Ed. Bek.*, p. 148. 12.); but it has been generally asserted to have been brought from America to England †, whence it passed to the continent of Europe, and that it was not known here until 1670. Mouffett, however (*Ins. Theatr.* p. 270.) mentions its having been seen in 1503. It has, however, been noticed as a singular fact, and as showing that this dis-

* Spinola has described some interesting peculiarities in the structure of this genus hitherto unnoticed. (*Essai*, p. 170.)

† Southall states that its first appearance took place after the great fire in 1666; "learned men," says he, "united in thinking they were imported with the new deal timber, as the bugs were naturally fond of turpentine woods." It is certain that they swarm in the American timber employed in the construction of new houses; and it is said that they feed upon the sap of that wood.

gusting visitant must have been comparatively little known in the days of 'good Queen Bess;' that, although the word bug occurs five or six different times in Shakspeare's plays, it is in every instance synonymous with bug-bear*, and does not designate this insect." (Patterson's *Shakspeare Letters*, p. 59.) From an observation made by Dufour (*Rech. Anat. Hemipt.* g. 11. p. 59.) it does not appear that these insects are able to subsist a very long time without food, and that, in such case, they do not destroy one another (although De Geer states the contrary to be the case), that author having kept some full-sized specimens in a sealed bottle for more than a year without food. Various plans have been suggested for the destruction of these insects. (See Curtis, 569. and Buchoz, *Hist. Ins. nuisibles*, 2 vols., Paris, an vii.) I have known a house which had long stood empty, and yet swarmed with them, thoroughly cleansed by fumigation with brimstone.

The eggs of these insects are white, and of an oval form, slightly narrowed at one end, and terminated by a cap which breaks off when the young escape. The latter are very small, white, and transparent, so that the blood can easily be seen through the body in this state (*fig.* 121. 4.); they are of a different form from that of the mature insect, having a much broader head, and shorter and thicker antennæ. (De Geer, *Mém.* tom. iii. pl. 17. f. 9—25.) They are eleven weeks in attaining their full size. For further details of the history of this insect, I must refer to the article Bug (*Brit. Cycl. Nat. Hist.* vol. i. p. 640.), in which I have given an account of the remarks of Southall, Oedmann, and Carlson, and to Griffith's *Animal Kingdom*.

Scopoli (*Ent. Carniol.* p. 354.), cited by Linnæus (*Syst. N.* vol. ii. p. 715.), who, however, questions the statement, mentions the occurrence of this insect with perfect wings. Fallen also (*Hemipt. Succ.* vol. i. p. 141.), and Latreille (*Hist. Nat.* tom. xii. p. 255.), notice the report of its being found winged, but without being able to confirm it. It has also been stated to occur winged in the East Indies; but Burmeister (*Handb.* vol. ii. p. 253.) seems to question this. Schil-

* Hence, in Matthews's Bible, the passage in the Psalms (xci. 5.), "Thou shalt not be afraid for the *terror* by night," is rendered, "Thou shalt not need be afraid of any bugs by night." Mouffett, whose work was published in 1634, gives "Wall-louse" as the common English name of the insect, not even mentioning its modern name of bug, which evidently accounts for Shakspeare's not noticing it under that name; although, had it been common, he surely would have done so under the name by which it was then known.

ling has indeed described a winged house bug, under the name of Cimex domesticus (*Isis*, 1834, p. 738.); but Burmeister has proved this (*Weigm. Arch.* No. iv. p. 71.) to belong to the genus Xylocoris *Dufour*. Hahn has evidently figured this insect under the name of Lyctocoris domesticus (*Wanz. Ins.* vol. iii. t. 79. f. 243.); but it belongs to a separate family. Fabricius, however, has described a species from South America, under the name of Acanthia hemiptera (*Syst. Rh.* p. 113.).

It has been long known that pigeons, swallows, &c., were infested with these insects. Latreille considered that the latter belonged to a distinct species; and the Rev. L. Jenyns has published the descriptions of it and two additional species, under the names of C. Columbarius, found in pigeons' nests, from my collection; C. Hirundinis, found in swallows' nests; and C. Pipistrelli, found on a bat.

The eighth family, TINGIDÆ*, consists of small species (*fig.* 120.12. Tingis (Monanthia) carinata), at once distinguished by the depressed and broad form of the body; the antennæ, with the terminal joints not thinner than the preceding; the rostrum very short, 3-jointed, and received into a gutter on the under side of the head (*fig.* 120. 13. head of Phymata manicata); the tarsi are often only 2-jointed (*fig.* 120. 14. tarsus of Aradus), although, in Dictyonota, they are figured as 3-jointed by Curtis (*B. E.* pl. 154.). There is considerable diversity in the structure of the few groups of which this family, even in its restricted state, is composed. Tingis, and the genera separated therefrom, have the thorax generally furnished with a membranous dilatation on each side, and posteriorly produced in the place of a scutellum, and being, as well as the large hemelytra, which entirely cover the abdomen, covered with reticulations of greater or less size. In the Aradi the scutellum is distinct, the thorax not dilated, and the wings, when closed, do not cover the abdomen, but leave its margins exposed. Macrocephalus and Syrtis have the fore legs strongly raptorial, resembling those of Naucoris in structure; these have also the

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* BIBLIOGR. REFER. TO THE TINGIDÆ.

Swederus, in Vetensk Acad. Handl. 1787. (Macrocephalus.)

And the general works of *Fallen*, *Burmeister*, *Laporte*, *Wolff*, *Hahn*, *Guérin*, *Curtis*, *Herrich-Schäffer* (Nomencl. Ent.), *Fabricius*, *Spinola*, *Encycl. Méth.*

abdomen much dilated at the sides, and not covered by the wings. In Macrocephalus the scutellum entirely covers the wings.* These variations of structure are dependent upon the various habits of the different groups; thus, the Aradi are found under the bark of trees, for which their very flattened form well fits them; the Tingides are found upon various plants and herbs, upon which they subsist, whilst the Macrocephali and Phymatæ are also found on plants and trees†, but they are described as feeding upon other insects, as the raptorial structure of their fore legs well indicates. Tingis clavicornis is described by Réaumur (Mém. 3. pl. 34. f. 1—6.) as attacking the flowers of Teucrium Chamædrys, of which it prevents the blossoming, causing them to swell out to a disproportionate size. T. Teucrii of Host, in like manner, injures the flowers of Teucrium supinum (Jacquin, *Collect.* tom. ii. p. 255.) T. Pyri attacks the leaves of the pear, and is known by the French gardeners under the name of "le tigre."

All the species are very slow in their motions; although Phymata crassipes is stated by L. Dufour to fly with agility, and to emit no scent.

In the memoir above referred to, Réaumur has figured the pupa of T. clavicornis, which has rudimental wings, extending half the length of the abdomen. De Geer has also figured the pupa and imago of an allied species (*Mém.* tom. iii. t. 16. f. 1—6.). In t. 15. f. 16—19., he has also figured the larva and imago of Aradus Betulæ. In the former the three thoracic segments are fully developed. L. Dufour has figured the larva and imago of a species, under the name of Aradus avenius, which is certainly identical with the Aneurus lævis *Curt.* This species is remarkable for having the wing-covers almost destitute of veins; the larva has the abdomen marked with six longitudinal series of ocelli-like black spots, the two middle rows being the largest (*Rech. Anat. Hemipt.* pl. 4. f. 36—41.) Mr. Ingpen has given me a larva, exactly agreeing with this figure, which he found in company with Aneurus lævis. I also possess the pupæ of several species of Tingis, one of which has the sides of the head, thorax, hemelytra, and abdomen beset with short spines: the others are unarmed.

* I have given a monograph of this and some new allied subgenera to the Entomological Society. The g. Discomerus *Lap.* is founded upon the structure of female antennæ of Phymata.

+ Ph. erosa is found commonly in the streets of New York, having fallen from the trees growing therein, as I am informed by Mr. Lewis.

The ninth family, CAPSIDÆ*, is of considerable extent, and consists of small prettily-coloured species, with the body convex, and of a soft consistence (*fig.* 120. 5. Capsus danicus), distinguished by the elongated antennæ having the second joint often thickened at the tip, and the terminal joints very slender; the rostrum long and 4-jointed (*fig.* 121. 6.); the labrum long; the ocelli wanting; the legs long and slender; the tarsi 3-jointed (*fig.* 121. 7. tarsus of Miris), and sometimes furnished with pulvilli; the coriaceous part of the hemelytra terminated by a large triangular piece, like a stigma, the apical membrane having only one or two strong veins, curved, and parallel with the apex of the wing, forming a basal semicircular cell. The females are further distinguished by having the ovipositor nearly half the length of the body, somewhat sabre-shaped, and received into a slit on the under side of the abdomen. These insects are very active, running and flying with agility, and frequenting plants and trees, upon the juices of which they appear exclusively to subsist. Some of the species are especially fond of ripe fruit, such as raspberries, which they suck with their rostrum, imparting a very nauseous taste to the fruit.

The family seems allied to the Reduviidæ and Cimicidæ in the structure of the antennæ, but it is questionable whether the relation be one of absolute affinity; and M. Brullé, considering the Coreidæ as nearest allied to the Tingidæ, has removed these insects to the end of the order. I prefer, however, retaining them, for the present, nearer to the Reduviidæ, which they certainly seem to approach, by means of the genus Nabis.

The pupa of Capsus danicus is clothed with short and somewhat clavate hairs.

Bryocoris *Fallen* (Orthonotus *Westw.*, Chlamydatus *Curt.*, Eurycephala *Lap.*, Astemma *Latr.*, Halticus *Hahn*), has the hind legs greatly elongated, with the femora thickened; the insects, which are of small size, leaping with agility; and the hemelytra are often destitute of the apical membrane. The species are generally found in sandy places, on the ground. The antennæ of the genus Heterotomus are remarkable for the thickness of the second joint; which joint, in the males of Harpocera (Azinecera *St. Cat.*) Burmeisteri

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* BIBLIOGR. REFER. TO THE CAPSIDÆ.

The general works of *Fabricius, Fallen, Panzer, Hahn, Burmeister, Spinola, Herrich-Schäffer, Zetterstedt, &c.*

Curt., is twisted and angulated at the tip; the same organs in Eucerocoris *Westw.*, *Trans. Ent. Soc.* (from Africa), are three times as long as the body.

The tenth family, LYGÆIDÆ*, is of considerable extent, and consists of species mostly of small or moderate size, distinguished by having the antennæ 4-jointed, with the terminal joint not thinner than the preceding, but not forming a terminal club as in the Coreidæ; they are inserted either beneath or at the margin of the head, in a line drawn from the eyes to the base of the rostrum. The body is generally narrow; the ocelli wanting in some groups†; the rostrum is of moderate length (*fig.* 121. 10.), with the joints of nearly equal length; the apical membrane of the hemelytra is furnished with longitudinal nerves, but rarely exceeding five in number; the tarsi are 3-jointed, with two pulvilli between the ungues.

Many of these insects are exotic, and are remarkable for their varied colours, in which red or yellow and black are most conspicuous. These are mostly found upon plants. Others, however, of a smaller size and of obscure colours, are distinguished by having greatly thickened fore legs; these are found on the ground, at the roots of plants, &c.

The typical genus Lygæus, as restricted to the species varied with red, white, and black colours, and possessing ocelli (L. equestris, &c.), approach very closely to such of the Coreidæ as Corizus Hyoscyami; but the difference of the veining of the hemelytra sufficiently distinguishes the two families.

One of the species of this family exhibits, in a remarkable manner, the ordinary occurrence of an imperfect perfect state; whilst occasionally individuals are found with perfectly developed organs of

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* BIBLIOGR. REFER. TO THE LYGÆIDÆ.

Dufour, in Ann. Soc. Ent. de France, vol. ii., and Annal. Sci. Nat. vol. xxii. (Xylocoris.)

Westwood, in Ann. Soc. Ent. de France, vol. iii.

Schilling. Entomol. Beitrage.

And the general works of *Hahn*, *Guérin*, *Burmeister*, *Spinola*, *Herrich-Schäffer*, *Perty*, *Boisduval.* (Voy. Astrolabe.)

† Laporte has united the groups which have no ocelli with the Capsidæ, forming them into an unnatural family named Astemmites.

flight*; this is the Cimex apterus *Linn.* (Pyrrhocoris calmariensis of Fallen, who has altered the specific name in consequence of its being thus inappropriate; *fig.* 121. 8. specimen with fully developed wing-covers, 121. 9. wing-cover of the ordinary form). This insect is found throughout Europe, occasionally in the greatest profusion. Such was the case, some years ago, on some little islands at Torquay in Devonshire, and also on a rock in the sea off Teignmouth, which, Mr. Curtis says, looked quite red with them. I found them in like profusion in the neighbourhood of Berlin, in September 1835, especially in the gardens of the palace of Charlottenburg, the walks of which swarmed with them: at this time they were engaged in sucking fallen berries and seeds†, as well as such of their companions as had been trodden under foot; at this time, also, I found some of the insects in the pupa state. From the details of the habits of this insect published by Hausmann (Illiger, *Mag.* vol. i. p. 229—491., translated by Brullé in *Hist. Nat. Ins.* tom. ix. p. 374.) it appears that they are even occasionally found crawling about the boulevards of Göttingen in January; they seem very sociable, collecting in little groups. Hausmann also observed their partiality for dead insects, and that they would not attack living ones. He also noticed that they undergo three moultings previous to their arrival at their ordinary perfect state; he, however, adds, that the winged or perfect specimens moult four times, acquiring wings only after the last moult: this would imply that the ordinary individuals are in the pupa state; but, from what has been already observed upon this subject, I have no doubt that the real pupa of these winged specimens differs entirely from the ordinary specimens, and would possess much shorter rudiments of wings, as well as 2-jointed tarsi, whereas the ordinary individuals possess three joints.

Lygæus brevipennis *Latr.* (belonging to the genus Aphanus, *Pachymerus, Schill.*), also, ordinarily occurs with abbreviated hemelytra, but which I have found with them perfect, as well as with wings.

* Mr. Curtis notices that climate seems to have a great influence in perfecting the wings, since he never found them winged in this country, although he took several winged in the South of France, — thus confirming the remarks made in previous pages as to the effect of heat in analogous cases. Linnæus, however, found a winged specimen in Kalmar, a Swedish province, in a latitude equal to the middle of Scotland.

† L. Dufour states that it is partial to the Malvaceæ, of which it pricks the capsules, and that it does not emit any disagreeable scent.

Microphysa *Westw.* (*Ann. Ent. Soc. France,* tom. iii. pl. 6.) comprises some minute species, ordinarily found under bark, with the abdomen very broad, and truncated hemelytra, resembling a broad Pselaphus.

Geocoris *Fallen* (Opthalmicus *Hahn*) is remarkable for the great breadth of the head; whilst Myodacha *Latr.* has the hind part of the head formed into a very long neck.

The largest species of the family is the Pyrrhocoris princeps *Westw., Drury,* vol. iii. pl. 43. f. 5. Another, nearly as large, is the P. grandis *Gray* (*An. K.* pl. 92. f. 3.), from India.

The eleventh family, COREIDÆ* (*fig.* 121. 11. Coreus hirticornis), is of great extent, and comprises some of the largest and most remarkably formed insects in the order, especially distinguished by the large, and either thickened or elongated† size of the terminal joint of the 4-jointed antennæ (*fig.* 121. 15. ant. of Pseudophlœus Dalmanni), which are inserted near the lateral and superior margins of the head above a line drawn from the eyes to the base of the rostrum; the rostrum is generally long or moderately long, with the third joint shorter than the fourth (*fig.* 121. 12. head of C. marginatus); the labrum is long; the ocelli are not widely apart; the apical membranes of the hemelytra are generally furnished with numerous longitudinal nerves; these organs often do not conceal the lateral margins of the abdomen; the legs are generally long, with 3-jointed tarsi, furnished with pulvilli beneath the ungues; the sternum is simple (*fig.* 121. 13. represents the underside of the thorax of Cor. marginatus).

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* BIBLIOGR. REFER. TO THE COREIDÆ.

Lister, in Phil. Trans. No. 72. (Cimex Hyoscyami).

Schilling. Entomologische Beitrage.

Thunberg. Dissert. Insect. Hemipt. tria Gen. illust., Upsal, 1825. 4to. (Pendulinus, *Pachylis,* and Copium, *Holhymenia.*)

Burmeister, Curtis, Say, Hahn, H. Schäffer, Perty, Guérin, Animal Kingdom, Palisot Beauvois, Wolff, Fallen, Laporte, Dufour, Stoll, Donovan.

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† The species, chiefly exotic, with the last joint long, form Laporte's family Anisoscelites.

These insects are generally diversified in their colours, and are found upon plants or trees, upon the juices of which they appear to subsist. They run and fly well, especially in the heat of the day; Coreus marginatus in flight makes a humming noise as loud as the hive bee. In many of the exotic species the hind legs are singularly enlarged, especially in the males, the femora in many being greatly thickened, curved, and spined; whilst in others the legs are very long, the femora thin, and the tibiæ furnished on each side with a broad and flat membrane, with the edges notched; the use of these singular appendages is involved in obscurity, the species not being saltatorial; in some, again, the femora are thickened, and the tibiæ curved and hooked at the tip, fitting to the femora like the fore legs of a Mantis; the antennæ also exhibit some curious modifications, the intermediate joints, or one of them, being occasionally dilated into a broad plate.

M. V. Audouin has observed the eggs of Coreus marginatus to be of a splendid golden appearance.

Some larvæ and pupæ which I possess of several of the species of Coreus (C. hirticornis, marginatus, and Scapha) differ from the imago in wanting ocelli, possessing only two joints in the tarsi (although there is a slight indication of an articulation in the middle of the terminal joint); their antennæ also are much thicker, especially the intermediate joint; the pupa of C. Scapha differs also from the imago in having the margins of the abdomen notched (*fig.* 121. 14.).

Some of the species of this family are of a very slender form; these belong to Latreille's exotic genus Leptocoris (not of Burmeister) and the British genus Neiedes (*fig.* 121. 16. N. tipularius), remarkable for the elbowed form of the antennæ at the end of the long basal joint. I have found N. elegans in great profusion in all its states about the roots and young stems of a small plant of Ononis arvensis, at the back of the Isle of Wight. Its motions are very slow, and I did not observe it to make use of its wings. The larvæ and pupæ were also found in company with the imago, and it appeared evident that it was from the plant that the insects derived their nutriment.

The genus Chorosoma *Curt.* (Myrmus *Hahn*, Rhopalus *Sch.*) comprises species of an elongated form, one of which, C. miriforme, (Lyg. micropterus *Burrell*, in *Trans. Ent. Soc.* vol. i. p. 74. 1807.), ordinarily occurs, and is described as possessing only short hemelytra: such is indeed the common appearance of the insect, and I have repeatedly captured such specimens *in copulâ*, although, at the same

time and place, I have found others of both sexes with fully developed hemelytra and wings.

A species allied to Alydus (Actorus fossularum *Burm.*, Alydus apterus *Duf.*) also exhibits a similar diversity of development. I also possess a species of Pyrrhotes *Westw.* (Leptocoris *Burm.* nec *Latr.*) from the Mauritius, having short hemelytra destitute of membrane, but possessing ocelli and 3-jointed tarsi.

The exotic genus Phyllomorphus comprises some of the most curious species of the family, of small size, and resembling a withered leaf with the edges notched and dilated. The type is the Cimex paradoxus *Sparrman**, from the Cape of Good Hope. I possess a new species of this genus brought from the Levant by Olivier. (See Guérin on this genus in *Bull. Soc. Cuvierr.* No. 8. 1839.)

Mr. A. White has described some new species belonging to this and the following family in a paper read before the Entomological Society.

The twelfth family, SCUTELLERIDÆ†, consists of an extensive assemblage of insects of moderate or large size, in general distinguished by the large size of the scutellum, the length of the 4-jointed rostrum, and of the transversely striated labrum; the elongated antennæ often consisting of five joints, the terminal joint not thickened nor ma-

* See his Memoir on this insect in *Vetensk Acad. Handl.* 1777.

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† BIBLIOGR. REFER. TO THE SCUTELLERIDÆ.

Lefebvre, in Guérin Mag. Zool. pl. 126. (Canopus). — Ditto, in Ditto, various detached species.

Dalman, in Ephem. Entomol. vol. i. (Canopus).

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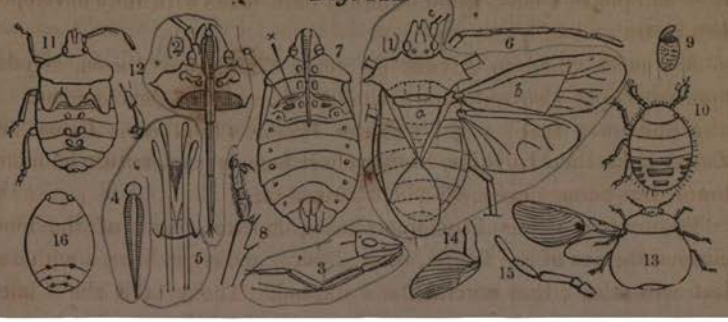
And the general works of *Dufour, Fabricius, Stoll, Wolff, Hahn, H. Schäffer, Perty, Burmeister, Drury, Klug, Laporte, Guérin, Spinola, Fallen, Zetterstedt*, &c.

Fig. 122.



terially elongated * ; the possession of two ocelli, and the ordinarily 3-jointed tarsi, furnished with two pulvilli. Several of the figures in the present page are intended, not only to illustrate the structure of the present family, but also the general characters of the land-bugs. *Fig.* 122. 1. represents Pentatoma rufipes about twice the natural length, with the antennæ and legs truncated, and with the wings on one side of the body extended; *fig.* 2. the under side of the head and prothorax of the same insect, showing the elongated 4-jointed rostrum (labium), the basal joint of which is partially covered by the elongated and attenuated labrum (*fig.* 4.); and at the apex are perceived the tips of the four enclosed setæ, representing the mandibles and maxillæ: *fig.* 3. represents the head of the same insect sideways, to show the lobes defending the base of the labium, and the manner in which the latter is able to bend, with two of the enclosed setæ drawn out at the tip of the second joint †; the tips of the other two, seen at the end of the rostrum: *fig.* 5. (after Savigny) represents the dilated base of the four internal setæ, as seen within the head on removing the clypeus: the two external setæ are the mandibles, and the other two the maxillæ; between the middle pair is perceived the pointed cartilaginous tongue ‡, behind which is a small oval aperture, which is the orifice of the pharynx: *fig.* 6. antenna of Pentatoma rufipes; *fig.* 7. under side of the body of Pent. smaragdina *Dufour*; × repre-

* See the interesting memoir of Burmeister, on the structure of the antennæ of this family, in Silbermann, *Rev. Ent.* No. 7.

† The setæ are capable of being drawn out of the entire length of the labium. De Geer has described the manner in which they are replaced; he, however, figures and describes only three setæ, whereas there are certainly four.

‡ Analogous to *fig.* 89. 8. ×, 9. × (p. 257.), and to the trifid tongue in Nepa, *fig.* 119. 13. (p. 458.)

senting the thoracic spiracles, and o the orifices for the emission of the volatile fluid, which produces the scent for which these insects are so well known: *fig.* 8. the fore tarsus and part of the tibia (slightly emarginate) of Pentatoma.

These insects are very varied in their colours, and amongst the exotic species are to be found many which equal the most splendid of the Coleoptera. They are found upon trees and plants, upon the juices of which they subsist, introducing their rostrum into the leaves. They will, however, attack other insects when opportunities offer, Latreille stating that several are occasionally to be seen surrounding and sucking a caterpillar; and Kuhn (in *Der Naturforscher*, st. 6., quoted by Fallen, *Hemipt. Suec.* p. 142.) states that six or eight specimens of Pentatoma bidens, shut up in a room swarming with the bed-bug for several weeks, completely extirpated the latter.

The eggs of these insects are varied in form, but generally of an oval shape, attached by one end to the leaves by a glutinous secretion, the other end being furnished with a cap* (De Geer, tom. iii. t. 13. f. 19—22., and my *fig.* 122. 9.), which the insect detaches on bursting forth: the young larvæ are of a rounded or oval form, with thick antennæ, a broad head, and the abdomen short (*fig.* 122. 10., and De Geer, *Mém.* tom. iii. t. 14. fig. 1. 10. 16.). De Geer (tom. iii. p. 262.) has made an interesting observation relative to the care with which the females of a species of this family (Acanthosoma grisea), found on the birch, defend their young. In the month of July he observed many females accompanied by their respective broods, each consisting of from twenty to forty young, which they attended with as much care as a hen does her brood of chickens. *Fig.* 122. 11. represents the pupa of Pentatoma rufipes, which, although much more nearly resembling the imago, still differs from it in possessing only four joints to the antennæ, two joints to the tarsi (*fig.* 122. 12.), and wanting ocelli; the scales of the fore wings are attached to the scutellum, and it will be seen that the rudimental hind wings only appear at the inner margin of the fore wings: each of the three middle segments of the abdomen are furnished with a pair of tubercles, having the appearance of spiracles; they have

* Kirby and Spence (*Introd.* vol. iii. p. 104. and pl. 20. f. 15.) describe the egg of a Pentatoma furnished, not only with a convex lid, but with a lever of a horny texture, and in the form of a cross-bow, for opening it, the handle being fixed to the lower part of the egg by a membrane, and the bow-part to the lid. See also Vallot on the eggs of this genus, in *Bull. Sci. Nat. de Ferussac*, Sept. 1830.

been described by Kirby and Spence (*Introd.* vol. iii. p. 714. and pl. 29. f. 22.) as pseudo-spiracles, and which M. Lefebvre, in his memoir on Canopus (*fig.* 122. 16.) has named *gibbosités excavées.**

There is a very great diversity of form in the insects of this family, of which the most striking consists in the immense development of the scutellum in many species, which has induced Laporte to separate them into two families, Scutellerites and Pentatomites, but the connection between the two groups is so completely established by many exotic species, that I have not adopted this mode of classification; in like manner, I have not employed the name Pentatomidæ for the entire group, since many exotic species possess but four joints in the antennæ, whereas the scutellum in all is large, and in many entirely covers the abdomen and wings when at rest: an example of this is given in *fig.* 122. 13. representing Coptosoma globus (15. its antenna), a small European species, in which the scutellum is broader than long; the fore wings are also very long, and from the peculiar form of the body in this group, it is necessary that they should be partially folded in repose (*fig.* 122. 14.), a peculiarity observed in no other Hemipterous genus. (See my memoir hereon in *Mag. Nat. Hist.*, n. ser., vol. ii.) The pupæ of the Scutelleridæ are very convex, but exhibit no extraordinary enlargement of the scutellum; this is even the case in some pupæ of a Mauritian species in my collection, closely allied to Coptosoma, belonging to my genus Plataspis. Dr. Klug has figured the larva (pupa?) of Tetyra ocellata (*Symb. Phys.* pl. 43. f. 7.), in which the scutellar region extends further over the back. The pupa of a species of Tesseratoma is also figured in Griffith (*An. Kingd. Ins.* pl. 93. f. 1.) under the name of T. ossa-cruenta. Amongst the exotic species, those comprising the genus Calidea deserve mention on account of their brilliant metallic colours; Dryptocephala, Discocephala, and Phlœa†, on account of their apparent relation with the Aradi; whilst Cephalocteus *Duf.*, Scaptocoris *Perty*, Oncomeris *Burm.*, Oncoscelis *Westw.*, and others,

* From M. Lefebvre's figures of this genus, which has so much perplexed entomologists, it is evidently an insect in an immature state, possessing no ocelli, 4-jointed antennæ, and 2-jointed tarsi: whether the insect always retains "cet état de *perfection imparfaite*," as suggested by M. Lefebvre, is perhaps, from these circumstances, questionable, as we have clearly seen that these imperfect perfect insects are imperfect only in respect to their organs of flight.

† The observations of Spinola on the relations of this genus have induced me to retain it in this family, from which it has been removed by Brullé.

exhibit various remarkable modifications of structure of different organs to which I can but thus refer. In Edessa, Acanthosoma, &c. the sternum exhibits several forms, the prosternum and mesosternum in the last-named genus being considerably produced into a porrected horn (*fig.* 121. 17.).

Order APHANIPTERA *Kirby.*

(Suctoria *De Geer;* Siphonaptera *Latreille;* Aptera *Lamarck, MacLeay;* Rhyngota p. *Fabricius.*)

Char. Wings four; minute scaly plates applied to the sides of the body, those of the metathorax being the largest.

Body compressed; tarsi 5-jointed; antennæ minute.

Mouth formed for suction; mandibles and lingua long and setiform; maxillæ small, triangular scales with 4-jointed palpi; labium minute, with 3-jointed palpi.

Larvæ vermiform; pupa inactive, incomplete.

This order is composed only of the different species of fleas, forming the family Pulicidæ * (*fig.* 123. 1. Pulex irritans ♀ magnified; 2.

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Guerin. Icon. R. An. Ins., and description of ditto.

Fig. 123.

ditto, natural size); insects of minute size, which, in regard to their structural details and natural relations, have greatly perplexed naturalists, who, founding their arrangements in ignorance of their real peculiarities, have placed these insects in situations which a more precise acquaintance with them has proved untenable. The body of these insects is compressed and covered with a hard shining integument clothed with sharp bristles arranged in transverse series upon the back and legs; the segments of the body are continuous, without any marked separation between the three principal parts; the head is small; the mouth is called a rostrulum by Kirby and Spence (*Introd.* vol. iii. p. 471.*), and is employed in suction. It is to Savigny and Curtis† that we are indebted for an acquaintance with the real structure of the parts of the mouth, which has been confirmed by my own dissections, and by the researches of M. Duges; a highly magnified view of the parts of the mouth has been published by Mr. Aldous, of which *fig.* 123. 3. is a very reduced partial copy, and *fig.* 123. 4. represents the parts of the mouth opened in front. The upper lip is entirely obsolete (if the part described as the lingua be not its real representative); the mandibles (scalpella *K. & S.*, tube *Hook*) are two elongated flattened setæ, with a central rib, and with the edges finely serrulated (*fig.* 123. 3, 4. *md.*, and 5.); these, with the lingua (ligula *K. & S.*, sucker *Hook*), which is of equal length, but more slender (*fig.* 123. 3, 4. *l* 3. and 7.), are united in the middle of the mouth to form an instrument which, from analogy with the

* These authors figure all the parts of the mouth (*Intr.* vol. iii. pl. 7. f. 8.); they, however, like many previous writers, accounted the maxillary palpi as antennæ, and hence their nomenclature of the other parts is inaccurate.

† Savigny (*Mém. sur l. An. sans Vertèbr.* pt. 1. p. 27. 1816) first published a description of the real structure of the mouth.

mouth of the suctorial Hemiptera, is probably employed in puncturing the flesh. At rest, these organs are defended by the labial palpi (*fig.* 123. 3, 4. *l. p.*, and 6.), which unitedly form a tubular haustellum, and which Duges figures as 5-jointed (*Ann. Sc. Nat.* tom. xxvii. pl. 4. f. 9.), and Curtis describes as 4-jointed, although he represents them in Pulex* as only 3-jointed, which appears to me to be their true structure, having an internal membranous connection. Latreille also describes them as 3-jointed (*Gen. Cr.* tom. iv. p. 365.). These palpi arise from the apex of a small membranous labium (*fig.* 123. 6. o, and *fig.* 123. 3. o), which is inserted upon a still smaller mentum (*fig.* 123. 6×); the maxillæ (laminæ *K. and S.*, biters *Hook*, *fig.* 123. 3, 4. *mx.*) are small, lamelliform, coriaceous, and subtriangular appendages, at the sides of the mouth, which appear articulated† near the tip; and the maxillary palpi (antennæ *K. & S.*, feelers or smellers *Hook*, *fig.* 123. 3, 4. *m. p.*) arise from their base at the anterior emarginate extremity of the head, and are porrected or rest upon the rostrulum, being composed of four joints; from their size and position they have been by many authors mistaken for antennæ ("antennæ, potius palpi," Latr. *Gen.* vol. iv. p. 365.).

The eyes are placed at the sides of the head, and are small and round‡, behind each of which is a small aperture, described as ordinarily closed by a moveable valve within which the antennæ are placed; these are minute articulated organs, varying in form in the different species, composed apparently of four joints (*fig.* 123. 9. ant. of P. Canis, 10. ditto according to Duges), the third of which is very minute, and forms the cup-shaped base of the terminal joint, which in some species is furnished with numerous transverse incisions, which have been considered as so many distinct articulations by Curtis (antennæ of Cer. elongatus 8-jointed; antennæ of C. Talpæ 10-jointed, *Curtis*, 417. and 417. *a*); occasionally these organs are withdrawn out of their cavity, and carried erect§ as in P. Musculi *Duges* (*fig.* 123. 8. *a*, *a x* being the valve beneath which they lie in repose).

* He figures them as 4-jointed in Ceratopsyllus.

† This apparent articulation results, as I have ascertained, merely from the extension of the inner membranous covering beyond the basal coriaceous substance.

‡ Duges describes them as "*lisses*;" and Hooke, as each being a "single lens, like a cat's eye." Mr. Newman (*Ent. Mag.*, No. 11. p. 404.) mentions their simple construction as not having been noticed by any previous writer.

§ In such cases they constitute the genus Ceratopsyllus *Curt.* I have, however, endeavoured to show that, from the variations of these organs in every species, it is not advisable to establish a genus upon this character. (*Ent. Mag.*, No. 4.)

The thorax is composed of three short segments, the second of which, or the mesothorax, has a small scale (*fig.* 123. 1 x) affixed at its hind margin, on each side, behind the coxa of the middle legs, and resting upon the coxa of the hind legs, whilst the metathorax has a much larger pair of these scales (*fig.* 123. 1 x x), which nearly cover the sides of the first and part of the second abdominal segment. These scales, evidently representing the four wings of the Ptilota, were first clearly defined by Duges, although Hooke had first represented them; Mr. Kirby, also (*Introd.* vol. iv. p. 383.), says that something like elytra and a scutellum appear, and MacLeay (*Horæ Ent.* p. 357.), that vestiges of wings are visible.

The legs are long, the posterior formed for leaping; the coxæ are very large; the fore legs are singularly placed, appearing to arise from the front of the head, the coxæ defending the sides of the rostrulum. This peculiarity is caused by the prothoracic epimera being detached from the body, and extended obliquely beneath the head. The large coxæ articulate in the four hind legs with the epimeræ * by means of a minute joint, which, according to M. Duges, does not exist in the fore pair; the coxa is succeeded by a minute trochanter, considered as a supplemental joint by Duges; the femora are short, but strong, the tibiæ very setose, and the tarsi 5-jointed, terminated by a pair of strong claws (*fig.* 123. 11.).

The history of these insects in the perfect state is well known; their eagerness for blood, and their powerful muscular activity, enabling them to leap to an amazing distance, and which has been turned to account by ingenious mechanics, for the purpose of making them perform various feats, such as drawing miniature carriages, &c., needs no lengthened account. The transformations of the insects are, however, especially interesting.

On opening the body of a female flea, ten or a dozen oblong eggs, of a rounded form and white colour, are discovered, which are deposited by the female in obscure places, such as cracks in the floor, or amongst the hairs of rugs, where dogs are accustomed to lie. From these eggs are hatched long worm-like grubs (*fig.* 123. 13, 14. ditto magnified), destitute of feet, with thirteen distinct (pilose, according to De Geer) segments; the last furnished with two hooks; the first, or the head, not variable in form, somewhat corneous, subovate, fur-

* M. Duges, erroneously regarding the epimeræ as the coxæ, the coxæ as femora, and the femora as tibiæ, has described the real tibiæ as the basal joint of the 6-jointed tarsi. He has corrected this error in his memoir on P. penetrans.

nished with short antennæ and oral appendages*, the precise structure of which has not been described (blind according to De Geer, but with two eyes according to Rösel). These larvæ are very active, twisting about in all directions, and feeding upon the fleshy particles of feathers and the blood of animals, especially drops of congealed blood found lying near the eggs: the last, at least, is stated to be their food by M. Defrance†, but this part of the history of the flea seems to require elucidation. When full grown, which occurs, in summer, in about twelve days, the larvæ enclose themselves in a small cocoon of silk, often covered with dust, and attached to adjoining substances. Rösel, however, observed that some of the larvæ underwent their transformations without forming any cocoon. The pupa (*fig.* 123. 16., 14. ditto magnified, 15. exuvia of the larva) is quite inactive, with the legs enclosed in separate cases; the colour of the pupa is at first dirty white, but it afterwards assumes the tint of the imago. The larvæ, which are not hatched until the end of the summer, pass the winter in that form. The period of the duration of the pupa state varies from eleven to sixteen days.

The changes which the flea undergoes were not unknown to Aristotle, since he noticed not only that it had distinct sexes, but also that they produced σκώληκες ὠοειδεῖς: from not, however, tracing the insect through its changes, he fancied this progeny was *sui generis*, and that the perfect insect was generated spontaneously in the earth, the Latin name Pulex being stated by Isidorus to have been derived from pulvis, "quasi pulveris filius." Mouffett also entertained a similar notion, whilst Scaliger thought they were produced from the humours amongst the hairs of dogs. It is to Leuwenhoeck (*Arcana Naturæ*, tom. i. p. 35. and 353.), Rösel (*Ins. Belust.* tom. ii., *Musc. et Culic.* tab. 2, 3, 4.), and De Geer (*Mémoires*, tom. vii. tab. 1.), that we are indebted for a knowledge of the real transformations of the insect.

There are numerous species of this genus, peculiar to various animals and birds. Duges describes four species, P. irritans, Canis, Musculi, and Vespertilionis; whilst Bouché describes ten species, P. irritans, Canis, Gallinæ *Schr.*, Felis, Martis, Sciurorum, Erinacei,

* The precise structure of these mouth organs has not been described: hence we are in doubt as to whether the larva be suctorial or mandibulated; if the former, the analogy of the order with the Coleoptera cannot be maintained.

† In the chapter on the flea, in the *Natural History of Insects*, in the *Family Library*, vol. ii., I have given an abstract of M. Defrance's observations, which are also stated in the *Encycl. Méth.* tom. x. p. 242.

Talpæ, Musculi, and Vespertilionis. The largest British species is found upon the mole, Ceratopsyllus Talpæ *Curt.* The largest species I have seen has been sent to me by Mr. R. H. Lewis, with the name of Pulex Echidnæ, that gentleman having captured it in Van Diemen's Land on Echidna Hystrix, or the Australian porcupine. P. gigas *Kirby* (*Faun. Bor. Amer.* p. 318. pl. 17. f. 9.) is two lines long, but it is not known upon what American animal it was found.

In warm and more especially in tropical countries, these insects are exceedingly troublesome; but in the West Indies and South America there is an insect belonging to the family having habits different to those of the common flea, which is even still more obnoxious; this is the Chigoe or Jigger, Pulex penetrans *Linn.**, an insect of very small size, which lives in the open country, and during the dry season incredibly multiplies in sandy and dusty places. It chiefly attacks the naked feet, both of men and dogs †, particularly between the toes and nails, burying itself deep into the skin, and occasioning by its constant irritation the most violent indisposition, inflammation, swellings, ulcers, and even death. After one of these insects has effected a lodgement in the skin, its body becomes enormously distended, acquiring the size of a pea (*fig.* 123. 17. seen in front; 18. ditto magnified, seen sideways); the head, thorax, and legs retaining their ordinary size, the abdomen alone becoming swollen and filled with an immense number of eggs; in this state the greatest care is requisite in extracting the mass entire. The specimens which thus burrow into the flesh are certainly impregnated females. No author has noticed the discovery of larvæ or pupæ in the feet or elsewhere; hence Pohl and Kollar (*Brasil. vorzugl. läst. Ins.* tab. annex. fig. 5., translated in *Mag. Nat. Hist.* vol. ix. p. 294.)

* Long regarded as an Acarus; it was first proved to be a flea by Olaus Swartz. Guérin (*Icon. R. An. Ins.* pl. 2. f. 9.), Dumeril (*Consid. Génér.* pl. 53.), and Pohl and Kollar have given figures of this insect. The two former figure, also, individuals with the abdomen of the ordinary size, terminated by a slender appendage, forked at the tip. Is this the male? Kirby and Spence (*Introd.* pl. 23. f. 10.), and Pohl and Kollar, have represented it without this appendage. Is this the unimpregnated female? M. Guérin has also figured (*Icon. R. An. Ins.* 2. fig. 9. *a*) a specimen of P. penetrans with the long anal appendage, which he doubtingly describes (in the description of the plates of the *Iconographie*, of which he has been so kind as to send me proof sheets) as the male organs of generation; the unimpregnated female not possessing this appendage, which, from the habits of the insect, cannot be an ovipositor.

† According to Pohl and Kollar (p. 10.), the Bicho do Cachorro, or dog chigoe, is a distinct species from the Bicho de pé, or P. penetrans.

conjecture that, like the common flea, it lays its eggs on the ground, whilst Dr. Rodschild (*Medecinische und Kyrurg. Bemerk. Colon. Essequibo, &c.*, Frankf. 1796, 8vo. p. 307.) is of opinion that the larvæ are developed within the abdomen of the mother, and there pass into the pupa state. Some specimens of the insect, presented to me by W. Sells, Esq., have enabled me to examine and describe the insect (in a memoir read at the Entomological Society), as well as to dissect the abdomen, which I found filled with ovaries containing an immense number of eggs: hence there is evidently no sufficient space for the development of the pupa, as suggested by Rodschild; whilst the fact, that if the nestled chigoe be unmolested, a fearful ulcer is found, which frequently extends to the bones, requiring amputation, seems to warrant the supposition that the larvæ are hatched in the wound, and it is by *their* action that the ulcer is formed; in such case we must further suppose that when full grown they leave their victim and undergo the pupa state in the earth, a proceeding of very common occurrence amongst parasitic insects. One thing, however, seems evident, that from their vast numbers their *ordinary* development must take place elsewhere than in the foot. In my memoir on this insect I noticed the obsolete structure of the labium *, and had thence, as well as from the difference of its habits, separated it generically under the name of Sarcopsylla or flesh-flea.†

The investigation of the natural relations of this order is attended with much difficulty: the opinions entertained concerning them by authors ignorant of their precise structure cannot be considered as entitled to much weight; and hence the situation assigned to them in the *Règne Animal*, between the lice and the beetles‡, is one of the most unnatural that could have been found for them. Lamarck had pointed out the relation of the flea to the Diptera resulting from its transformations; and Strauss Durckheim (*Anat. du Hanneton*, p. 5. 9,

* M. Duges, in his memoir, published subsequent to the reading of my memoir, also noticed this peculiarity, but nevertheless did not think it necessary to separate it generically from the common flea.

† The same opinion was also held by the Rev. L. Guilding, who, in his collection, had applied the generic name of Sarcophaga to this insect; this name I should have retained, had it not been long preoccupied for the flesh-fly. M. Guérin has named it Dermatophilus in his description of the plates of the *Iconographie* (not yet published).

‡ Mr. MacLeay insists upon this order being considered as the analogical representative of the order Coleoptera, in consequence of the similar nature of their transformations.

10.) asserts that "la puce est un Diptère sans ailes." Duges admits this relation, but considers the relation with the Hymenoptera* to be equally strong. The articulated sheath of the rostrum, as the labial palpi have been called, has been supposed to establish a relation with the suctorial Hemiptera†; but as this sheath is but a pair of articulated palpi, we must look elsewhere for the grounds of the relation, if it in fact exist. Whether the elongated exarticulate organs in the interior of the mouth can be considered as analogous (but merely from their action) to the setiform mandibles and maxillæ of the Hemiptera, is, perhaps, questionable: beyond these I can perceive no further bond of union between the two orders; and the elongated maxillary palpi and the want of a labrum are characters quite at variance with those of the Hemiptera.

Order DIPTERA‡ *Aristotle.*

(Antliata *Fabricius*; Halteriptera *Clairville.*)

Char. Wings two; mesothoracic, membranous, not capable of being folded, with variable neuration, accompanied at the base by a pair of small alulets.

* The transformations of this order agree with those of the flea; and an analogy may, by the exercise of considerable ingenuity, be traced between the parts of the mouth of the two orders; but the flea has a suctorial, and the Hymenoptera a masticating mouth. (See Vol. I. p. 8.)

† Hence MacLeay (*Horæ Ent.* p. 379.), adopting the views of Latreille (*Hist. Nat.* tom. xiv. p. 404.), places the flea between the Hemiptera and such Diptera as have the sheath of the rostrum bivalve but not articulated. Its nearest relations among the Diptera are, however, such species as have an incomplete pupa. Some of the fungivorous Tipulidæ, especially Cordyla, as suggested by Mr. Haliday (in Curtis, Ceratophyllus), make the closest approach. In their parasitic habits, however, they make a nearer approach to the Hippoboscidæ.

‡ Bibliogr. Refer. to the Diptera in general.

Schellenberg. Gattungen der Fleigen, 8vo. Zur. 1803.

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Fabricius. Systema Antliatorum, 8vo. Brunsw. 1805.

Fallen. Diptera Sueciæ descripta, 2 vols. 4to. Lund. 1814–1827. —Ditto, Suppl. Dipt. Suec. Lund. 1826.

Wiedemann, in his Zool. Magaz. vol. i. st. 1, 2, and 3. — Ditto, Nova Dipterorum Genera, 4to. Kiliæ, 1820. — Ditto, Diptera Exotica, 8vo. Kiliæ, 1821.— Ditto, Analecta Entomologica, 4to. Kiliæ, 1824. — Ditto, Aussereuropaische zweifl. Ins., 2 vols. 8vo. 1828–1830.

Metathoracic wings, replaced by a pair of small slender filaments clubbed at the tip (halteres, poisers, or balancers, "malleoli, or little hammers," *Swammerd.*).

Mouth antliate, with a fleshy proboscis (labium), forming a canal, and enclosing several lancet-like organs, varying in number, but always destitute of labial palpi.

Tarsi 5-jointed.

Prothorax reduced to a very small collar.

Pupa coarctate or incomplete.

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Say. Descriptions of Dipterous Insects of United States, in Journal of Acad. Nat. Hist. of Philadelphia, vol. iii. 1823, 1824. — Ditto, Dipt. of United States, in ditto, vol. vi. pt. 1, 2. (See also Guérin, Bull. Zool. p. 33.)—Ditto, American Entomology.

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Schelver. Betrachtungen, &c. über den Flug u. d. Gesumme einig. zw. Ins., in Wiedemann's, Archiv., 2 b. 2 st.

Burmeister, in Poggendorff's Annalen, and Silbermann's Rev. Ent. No. 4., and in Taylor's Sci. Mem. pt. 3. (Noise made during flight.)

Walker. Diptera of N. Holland, in Ent. Mag. vol. ii. p. 468. — Ditto, in Trans. Linn. Soc. vol. xvii. — Ditto, in Entomol. Magazine, *passim.*

And the general works of *Linnæus, Latreille, Guérin, Boisduval, Kirby, Geoffroy, Panzer, Harris* (Exposit. Engl. Ins.), *Waltl* (Reise nach Spanien), *&c.*

The two-winged insects constitute one of the most extensive orders of the PTILOTA, not only in respect to numbers of *distinct species*, but also to the swarms of individuals of the *same species*; and which, from their constant attendance upon man, have attracted his attention from the earliest ages. It is not, however, from their size that this has been the case, since few species exceed an inch in length; nor is it on account of their beauty, for the majority of them are of dull colours; their forms, too, are rarely elegant, and the transformations of many are unknown. They owe their notoriety, if we may so speak, in many cases, to the disgusting habits and appearance of their preparatory states, when many of them revel in filth of every description; and to the annoyances caused by the reiterated attacks of their numberless tribes in the perfect state, both directly upon ourselves, and indirectly upon our living and dead property of almost every kind. When it is borne in mind, that one of the plagues of Egypt was caused by "swarms of flies"*, and that the gnat, the musquito, gad-fly, breeze-fly, Zimb, Stomoxys, &c. are Dipterous insects, which are unceasing in their attacks upon man as well as upon many of our domestic animals, it will be at once perceived that the order comprises some of the most formidable of our insect enemies.

Other species, as the Œstri, deposit their eggs upon the bodies of animals, within which the grubs, when hatched, feed: others for the same purpose infect meat and other viands used for food; and so great are their powers of multiplication and voracity, that, according to Linnæus, "tres muscæ consumunt cadaver equi, æque cito ac leo" (*Syst. Nat.* vol. ii. p. 990.). Other species of flies deposit their eggs upon young corn and other fruits of the earth, occasionally in such numbers as completely to destroy the hopes of the agriculturist. On the other hand, by clearing the surface of the earth of vegetable and animal impurities, and noxious insects, many Dipterous insects are to be regarded as unusually serviceable.

* In the *Brit. Cycl. of Nat. Hist.* (vol. iii. p. 298.), and *Entomol. Text-Book* (p. 17.), I have endeavoured to prove (contrary to the opinions of various writers), that the plague of flies was produced neither by the zimb, flesh-flies, nor dog-flies (κυνομυία), but by "swarms" of musquitoes; the circumstance stated as miraculous, namely, that the land of Goshen, in which the children of Israel dwelt, was not subjected to their attacks, being caused by the sandy nature of the pasture soil of Goshen not watered by the Nile, which was consequently free from situations favourable for the breeding of Culicidæ.

The head in these insects is almost invariably distinct, and attached to the thorax by a very short and narrow neck; the eyes are large and lateral, those of the males, in many species, occupying nearly the whole of the head; the ocelli are generally present, and three in number; only two, however, are found in some of the Tipulidæ. The antennæ are generally inserted on the forehead, and approximating at the base; they are of very variable construction: there appear, however, to be two distinct types of formation*; one exemplified in the Tipulidæ, in which these organs assimilate to those of many preceding groups, being composed of a series of distinct continuous articulations, often ornamented with whorls of hairs, bristles, &c.; the other occurring in the greater number of Diptera, in which the antennæ, unlike those of any other tribe, are very short and apparently composed of only two or three thick joints, the last of which is generally the largest, and is furnished with a bristle (arista) on its upper edge; this joint, however, is, in fact, composed of several of the articulations observable in the other type soldered together, the bristle representing also two or three other joints, — it being quite easy, as we shall see in the sequel, to trace the gradation of structure through the various families.

The mouth of these insects is formed only for imbibing fluid matter; when, therefore, such fluid is enclosed in peculiar vessels, the internal pieces of the sucker are employed as lancets to pierce the envelope and afford a passage to the fluid, which ascends by power of suction, produced by the fleshy lips of the insect into the mouth. The outer case of the rostrum evidently represents the lower lip of the mandibulated orders, having the sides turned up, so as to form a canal, for the double purpose of containing the other parts of the mouth, and of forming a channel for the flowing up of liquids into the pharynx: these internal pieces of the mouth are variable in number in the different families, but are found in their greatest state of development in the blood-sucking gnats and breeze-flies, in which the upper lip, the two mandibles, the two maxillæ, and the tongue of other insects are represented under the form of lancet-like organs: another pair of jointed organs is also attached to some part of the rostrum, or to that pair of lancets which represents the maxillæ; whence it is evident that they are the true analogues of the maxillary palpi, although the maxillary setæ themselves are sometimes obsolete.

* See MacLeay on the antennæ of this order, in Taylor's *Philos. Magaz.* 1827.

The thorax in these insects is short and robust, the distinctness of the various portions being much diminished, and the size of many of them reduced, in pursuance of the rules of proportionate development, resulting from the existence of only one pair of wings; hence the prothorax is very minute, the collar only being slightly visible, whilst the mesothorax extends nearly over the whole thoracic region: at the sides of this segment a pair of naked membranous wings * are placed, having, in many species, attached to their base behind a pair of small membranous appendages, termed alulæ, or winglets, which vary in size in an inverse proportion to the size of the halteres, and which have been regarded by some entomologists as the analogues of the lower pair of wings in the other orders; at the base of the halteres, as well as behind the collar, there exists a pair of spiracles. (See *fig.* 126. 1., and 128. 8.)

The halteres †, as Dalman well observes (*Analect. Ent. sub Chionea*), are the most characteristic organs of the order, being present even when the wings themselves are wanting. They are generally kept in constant vibration; respecting their uses ‡, however, as well as their analogies, dependent upon the analogous formation of the posterior portion of the thorax, entomologists are at variance; some authors regarding them as representatives of the posterior pair of wings, whilst others, including Audouin and Latreille, deny them this cha-

* Whilst many entomologists have endeavoured with very great pains to reduce the variable position of the nerves of the wings of the Hymenoptera to one typical form, the typical neuration of the wings of the Diptera has been but little investigated. Latreille has partially attempted its elucidation (*Genera, &c.* tom. iv. p. 237.); and see MacLeay, in *Zool. Journ.* Nos. 2 and 16. (in paper on *Ceratites*). An observation worthy of consideration in respect to this subject, has been made by M. Macquart (*Hist. Nat. Ins. Dipt.* tom. i. p. 11.), that if we compare the wing of one of these insects with the fore wing of one of the Hymenoptera, we cannot trace any analogy between the neuration of the two; but if both wings of the latter are thus compared with the single wing of the Dipterous insect, we are easily able to distinguish in the latter the various cells of the former; and hence, that the single wing of the Diptera represents both wings of the Hymenoptera, and that the halteres consequently cannot represent the hind wings.

† See Robineau Desvoidy, on these organs, in Ferussac's *Bulletin* for May 1827.

‡ From being connected with the metathoracic spiracle, they have been regarded as appendages of the respiratory system. See Schelver (in Wiedemann's *Zool. Archiv.*), Burmeister (in Poggendorff's *Annalen*, translated in Taylor's *Scientific Memoirs*, vol. i. pt. 3., and in Silbermann, *Rev. Entomol.* No. 4.), on the noise made by insects in flight; and see Kirby and Spence (*Introd.* vol. ii. p. 360.), on the variations in the alary organs and flight of the Diptera.

racter, regarding them as abdominal appendages, in accordance with their theory relative to the hind part of the thorax of the Diptera and Hymenoptera; and Messrs. Kirby and Spence consider them as appendages of the respiratory organs. From a careful investigation of their structure and position in the chief types of the order, as well as from a comparison of the Dipterous and Hymenopterous thorax, it appears to me that the same arguments by which I have endeavoured, in a previous page, to prove that the hind part of the middle portion of the body in the petiolated Hymenoptera is thoracic, are equally applicable to these insects, in order to show, not only that such is also the case in the Diptera, but also that the halteres are the real analogues of the hind wings; and, consequently, that the alulets are merely appendages of, or, in fact, not distinct organs from, the upper wings. Latreille, indeed, in several of his latest works, instanced the larger Tipulidæ as showing that the halteres cannot be analogous to the hinder wings, inasmuch as they are attached to the segment, which bears a pair of spiracles, which, he asserts (but erroneously), is never the case with the metathorax; but, on carefully examining Tipula oleracea, it is quite impossible to arrive at any other conclusion than that the segment which bears the halteres and pair of spiracles is also that which bears the hind legs, and which is consequently the metathorax. Moreover, it unfortunately happens, for the theory of the French entomologists, that the abdomen of this and other allied insects possesses the full complement of segments, without taking this supposed basal segment into the calculation. I have represented the various developments of these thoracic organs in several Dipterous insects in the following figures.

The legs are long, and terminated by a 5-jointed tarsus, having two claws at the extremity, with two or three fleshy vesicles or pulvilli.* The abdomen is united to the thorax by a considerable portion of its

* These pulvilli, or, as Derham terms them, "skinny palms to the feet," have been generally regarded as the instruments wherewith, by means of the pressure of the atmosphere, flies are enabled to creep on the upright surfaces of glass and other polished surfaces against gravity. Mr. Blackwall has, however, lately published a very ingenious paper, proving that it is impossible, from the structure of these organs, covered as they are with minute bristles, to be employed as suckers, and suggesting that it is by strictly mechanical means, as suggested by Dr. Hooke (*Micrographia*, p. 171.), that they are enabled to retain their hold. (*Linn. Trans.* vol. xvi. p. 490.) In a subsequent communication, he however considers that an adhesive secretion is emitted by the hair-like appendage on the inferior surface of the pulvilli, which are considered to be tubular; a distinct track of this secretion being discoverable in every instance. (*Linn. Trans.* vol. xvi. p. 768.)

transverse diameter, and is composed of from five to nine joints, terminated in a point in the females; in some of the latter the number of joints is reduced; the apparently wanting segments are, however, converted into a telescopic-formed ovipositor.

The transformations of this order are either of the incomplete or coarctate kind, or rather such is the nature of the pupa state.

The larvæ are fleshy, cylindric, footless grubs*; but some species are furnished with representatives of legs. It is in this order alone that the head is found to exhibit a soft, fleshy, and variable structure; a character, however, exclusive to those Diptera which have a coarctate pupa. The mouth is generally furnished with two hooks, which are thrust into the substances from which the larvæ derive their nutriment. In the majority of these larvæ the spiracles, two in number, are situated at the posterior extremity of the body; many are also furnished with a pair of these organs on the segment immediately succeeding the head, and in some they are placed on several of the consecutive segments. When arrived at their full size, the larvæ of some of the species (Nemocera and Tanystoma) cast their skin, and appear in the form of incomplete pupæ, having their limbs enclosed in distinct sheaths. The pupæ of the Culicidæ are not, however, quiescent. This transformation is sometimes effected in a cocoon woven by the larva. In the majority of the order, however (Muscidæ, &c.), the outer skin is not shed, but, by degrees, contracts and hardens, until it assumes the appearance of an oval brownish shell or case, within which the body of the larva is detached in a soft and gelatinous mass, and which exhibits no appearance of limbs or joints; by degrees, however, these parts are found (on opening the shell) to have become distinct when the insect is in the true state of a coarctate pupa. In some species, however, the larva skin scarcely changes its form, on the insect's assuming the pupa state. The perfect insect makes its escape from this case by causing the upper extremity to scale off, having also sloughed off the real envelope of the pupa. In the forest flies, Hippoboscidæ, a remarkable variation occurs; the insect passing the larva state, and

* Bouché (in *Nova Acta Natur. Curios.* vol. xvii.), MacLeay (in *Zool. Journ.* vol. ii. No. 5., and Taylor's *Philos. Magazine*, 1827; *Bull. Féruss.* February 1829), and Dufour, in a memoir presented to the "Institut," upon some fungivorous Dipterous larvæ presented to the "Institut," and noticed in the *Révue Zool. Soc. Cuvier.* 1839, No. 7., have entered into numerous general details relative to the larvæ of this order.

undergoing the change to the pupa in the abdomen of the mother; and being deposited in the shape of a large oval mass covered by a thick skin.

The situation of the Diptera amongst the orders of insects is considered by Mr. MacLeay to be intermediate between the Lepidoptera, with which they are supposed to be connected by means of such insects as Pterophorus *Fabr.* (Phalènes tipules *D. G.*) and Psychoda *Latr.* (Tinearia *Schill.**) and the order containing the fleas, Aphaniptera; which latter relationship is deemed to be effected by means of Hippobosca†, Nycteribia, and Pulex; whilst the analogous appearance exhibited by different species in almost every Dipterous family with the Hymenoptera, has not failed to attract the attention of every observer. These orders are accordingly analogically opposed to each other in the mandibulated and haustellated columns of the systems of Savigny, MacLeay, and Kirby and Spence. (See K. and S., vol. iv. p. 412—415.)

It is to Aristotle that we are indebted for the first indication, as well as the name, of this order; and by whom it was divided into two sections, one of which (Emprosthocentra) he distinguished from its counterpart amongst the Tetraptera (Opisthocentra) from possessing an oral instead of an abdominal sting. Swammerdam, pursuing the principle of metamorphosis, united one portion with the Coleoptera, Hymenoptera, &c. undergoing an incomplete metamorphosis, whilst the remainder, undergoing a coarctate metamorphosis, he erroneously placed with the Ichneumones minuti *Linn.* Linnæus, in his later works, established it in its present extent, in which respect he was followed by De Geer. Fabricius, however, pursuing the cibarian characters, united it with the Anoplura *Leach*, Trachean Arachnida *Latr.*, &c. under the name of Antliata, a step which has not been adopted except by his immediate followers. Clairville also proposed for it the name of Halteriptera. More recently Dr. Leach proposed to establish the Linnæan genus Hippobosca as a distinct order, under the name of Homaloptera.

* Burmeister thinks the long rostrated Bombyliidæ and Tabanidæ, which he places in conjunction, lead to the Lepidoptera (*De Insect. Syst. Natur.* p. 25.). This relationship is, however, more apparent than real; the labium of the Diptera being lengthened at the expense of the maxillæ, &c.; whereas, in the Lepidoptera, the maxillæ are developed at the expence of the labium, &c.

† The stirps Pupipara (Hippobosca), &c. is also deemed by Mr. MacLeay as establishing the passage between the classes of Haustellata and Arachnida. I have introduced some observations upon this transition in my remarks upon this stirps.

Moses Harris was the earliest British author who paid peculiar attention to the insects of this order, and was the first entomologist who made use of the variations in the nervures of the wings to distinguish the groups. More recently, these insects have attracted much attention abroad; Fallen, in Sweden, having published many memoirs respecting them; Macquart has also published an admirable series of monographs upon the Diptera of the North of France, as well as several subsequent general works. But it is chiefly to Meigen, whose work upon the Diptera of Europe extends to six volumes, and to Wiedemann, whose *Exotic Diptera* occupies two volumes, that we are indebted for the most complete series of descriptions of the species of this order, whilst it is to the works of Latreille that we must look alone for the more philosophical views relative to the affinities and consequent relative situation of the various families of Diptera, the preceding authors having implicitly followed him in his modes of distribution.

The natural classification of the Diptera is attended with great difficulty, resulting from the difference in value which may be attached to the characters respectively derived from the structure of the antennæ and trophi, and the nature of the transformations; hence we find that Latreille, in many of his works, has adopted various plans of arrangement, and has likewise suggested others, varying according to the different rank supposed to be possessed by either of these principal characters. Thus, in the "Genera Crustaceorum," the antennæ are first employed, and thus we have the Stratiomidæ, in consequence of their multi-articulate antennæ, but which have a coarctate pupa, and a mouth furnished with two or at most four setæ, introduced between the Tipulariæ and Tabanii, which last have an incomplete pupa like the Tipulariæ and a more complete mouth. In a note, however, in the same work there is another arrangement proposed, chiefly founded on the structure of the mouth *; and here we have the Tabanii brought into contact with the Tipulariæ, whilst the Stratiomidæ are removed

* M. Macquart has nearly adopted this proposed arrangement, without acknowledgment, in his *Suites à Buffon*, as follows: —

Div. 1. NEMOCERA (composed of Culex and Tipula).

Div. 2. BRACHOCERA.

Subdiv. 1. *Hexachæta*, with six setæ in the mouth (Tabanus).

Subdiv. 2. *Tetrachæta*, with four setæ, composed of three families — A. *Notacantha* (Stratiomys, &c.), B. *Tanystoma* (Asilus, Empis, Bombylius, &c.), and C. *Brachystoma* (Rhagio, Dolichopus, Syrphus, &c.).

Subdiv. 3. *Dichæta* (composed of the Athericera and Pupipara of Latreille).

nearly to the end of the order with the Muscidæ, whereas the structure of the antennæ of these two groups is totally at variance with such an arrangement. In the *Familles Naturelles*, we find the preference given to the nature of the metamorphoses, and hence the order (after the removal of the Pupiparæ) is divided into four primary families, thus arranged: 1. Nemocera, 2. Tanystoma, 3. Notacantha, and 4. Athericera; the 3d, composed of the Stratiomidæ, agreeing with the 4th in having a coarctate pupa, whilst the 1st and 2d have the pupa not enclosed within the skin of the larva.

Still, however, there is a diversity in the nature of the metamorphoses of the third and fourth groups; the larva skin of the Stratiomidæ nearly retaining its form, whilst that of Musca and the other Athericera is completely altered, assuming that of an oval inarticulate mass. "La nature," observes Latreille, "d'après ses vues particulières, et qui nous sont inconnues, varie sa marche et ses combinaisons." (*Consid. gén.* p. 85.) And hence it is, that whilst Culex and Chironomus are so intimately allied in general structure and metamorphoses, as to be united into the same natural family by some writers *, the structure of their mouths is totally different, that of Culex being exceedingly developed, even to a greater extent than in the Tabanidæ, with which, however, it agrees in the number of the pieces of which it is composed; an arrangement, therefore, founded on the structure of the mouth, in which Tabanus and Culex would be united, must be artificial. How far the circumstance of some of these insects possessing a coarctate pupa ought to be considered as superseding other considerations, originating in the characters of the perfect state, may perhaps be questioned, when we consider that a *coarctate* pupa is in fact nothing else than an *imperfect* pupa enveloped in the larva skin †, far more analogous to the true *incomplete* pupa of the bee and the beetle, than it is to the *obtected* pupa of the Lepidoptera.

If, again, independently of metamorphoses or trophi, we look to the antennæ, and other characters of the imago, for affording the grounds of a natural arrangement, we still find it difficult to decide whether the Tabanidæ or the Notacantha are nearest related to the Tipulidæ, the former group by Macquart, and the latter by Latreille, being made to occupy this station. By the arrangement of Macquart,

* Latreille (*Genera*, tom. iv. p. 245.) unites them into a section under the name of Tipulariæ aquaticæ.

† In some species of beetles, the incomplete pupa is inclosed in the skin of the larva (Anthrenus, Chilocorus), thus being, in fact, coarctate pupæ.

Latreille's admirable group Tanystoma is cut up, as it appears to me unnaturally; and hence, although there is a great hiatus between the Tipulidæ and the Notacantha, and the antennæ of some of the latter (Sargus, &c.) are aristate, I feel inclined to retain the Notacantha in the situation assigned to them by Latreille in his "Genera."

From the peculiar construction and transformation of the Hippoboscidæ and Nycteribiidæ, they are admitted by authors to form a distinct and terminal section of the order, under the name of Pupipara; the Œstridæ, Muscidæ, &c. having in several respects a nearer affinity with these than any other Dipterous insects, will occasion their near approach to them in the system; whilst of all the remaining Diptera the Tipulæ and Culices, from their structure and transformations, are evidently the farthest removed from the latter, and at the same time nearest allied, both in their transformations and antennæ, to some of the preceding tribes of insects.* The following distribution, therefore, nearly resembles that of Latreille's Genera, the families of the Tanystoma being transposed: —

Section 1. Head always distinct from the thorax; claws of the tarsi not dentated; larva annulose, not undergoing its transformations to the pupa state within the body of the parent; female insects oviparous (or larviparous, some Muscidæ).

Division 1. (Stirps 1.) Nemocera *Latr.* Antennæ composed of more than six joints; palpi 4 or 5-jointed; pupa incomplete (Fam. *Culicidæ* and *Tipulidæ*).

Division 2. Brachocera *Macq.* Antennæ short, not having apparently more than three distinct joints; palpi 1 or 2-jointed.

Stirps 2. Notacantha *Latr.* Antennæ apparently composed of only three joints, the last, however, being articulated; proboscis exserted, seldom enclosing more than two lancets. The structure of the mouth is very incomplete, and the number of the setæ variable. Latreille (*Genera*) gives only two as its character, but four in the *Règne An.* 2d ed.: in the former case and in metamorphoses, general appearance, and, as it would seem (*Règne An.* p. 479., but see p. 485. *contrà*), in the variable form of the head of the larva, this stirps approaches the Athericera. Pupa coarctate, the skin of the larva, however, nearly retaining its previous form (Fam. *Stratiomidæ*, *Beridæ*, and *Cœnomyidæ*).

Stirps 3. Tanystoma *Latr.* Antennæ with only three joints, ordinarily terminated by a seta (Tabanus excepted); proboscis exserted, generally with four setæ (six in Tabanidæ ♀; mouth obsolete in Acroceridæ); larva with a scaly head; pupa incomplete (Fam. *Tabanidæ*, *Bombyliidæ*, *Anthracidæ*, *Acroceridæ*, *Empidæ*, *Tachydromiidæ*, *Hybotidæ*, *Asilidæ*, *Mydasidæ*, *Therevidæ*, *Leptidæ*, *Dolichopidæ*, and *Scenopinidæ*.

Stirps 4. Athericera *Latr.* Antennæ with only two or three joints, ter-

* Hence the species which have coarctate pupæ and short setigerous antennæ are evidently most typical of the order.

minated by a seta; proboscis generally withdrawn into the oral cavity, with two setæ (four in the Syrphidæ; mouth obsolete in the Œstridæ); pupa coarctate, the skin of the larva forming an oval case (Fam. *Syrphidæ*, *Conopidæ*, *Muscidæ*, and *Œstridæ*).

Section 2. (Stirps 5.) Pupipara *Latr.* (Order *Homaloptera* Leach). Head immersed in the thorax; claws denticulated; larva nourished in the abdomen of the mother, and not deposited until after it has passed to the pupa state (Fam. *Hippoboscidæ* and *Nycteribiidæ*).

The four stirpes composing the first great section of the Diptera are distinguished by having the head more or less detached from the thorax, the antennæ not concealed in lateral excavations of the head, the setæ of the mouth enclosed in a fleshy canal bilobed at its extremity, and the claws of the tarsi not denticulated; these insects are oviparous, with the exception of a few Muscidæ, which do not exclude their young until they have assumed the larva state.

The first division comprises such species as have the antennæ divided into a considerable number of distinct and nearly equal-sized joints. This division comprises the single stirps Nemocera *Latr.* In the second division (comprising the Notacantha, Tanystoma, and Athericera), the antennæ have the terminal joints either indistinctly articulated or completely soldered together.

The first stirps, Nemocera, corresponds with the genera Culex and Tipula of Linnæus, the antennæ of which are, for the most part, composed of from 14 to 16, or from 6 to 9 joints: they are filiform or setaceous, much longer than the head, and often ornamented with whorls of hair, especially in the males; the body is long, with the head small and rounded, the eyes large, the rostrum not concealed, with two external palpi composed of 4 or 5 joints, the thorax very elevated, the halteres long, the alulæ scarcely perceivable, and the legs very long and slender.

Many species of the smaller size assemble in myriads in the air, where they perform their dance-like flights.* These assemblies (which consist almost entirely of males) may be observed almost throughout the year, and it is here where the intercourse of the sexes takes place, after which the females deposit their eggs, either in neighbouring water or upon plants. The larvæ are always long and vermiform, with a scaly head of a constant form, and a mouth presenting organs representing the lips and maxillæ. They shed their skin previous to

* I have observed that in these dances the insects always fly with their heads towards the quarter from which the wind blows.

assuming the pupa state, which somewhat resembles the perfect insect, except that the limbs are enclosed in distinct sheaths, and folded upon the breast and convoluted beneath the wing cases.

This stirps comprises only two families, Culicidæ and Tipulidæ; the first of which so closely approximates to the aquatic Tipulidæ in all respects except the structure of the trophi, that Meigen, following Latreille, unites them into one section of the Tipulariæ. Macquart also, in his last work, has sunk the former as a distinct family, observing that the discovery of an elongated proboscis in his Tipulideous genus Aporosa (to which he might have added my Limnobiorhyncha and Haliday's Geranomyia), and of maxillary setæ in Glochina and Boletophila, rendered the characters of the Culicidæ of less importance than had been given to them. (*Dipt. Exot.* p. 28.) The blood-sucking propensities of the Culicidæ are, moreover, met with in several of the small Tipulidæ, especially Simulium. I must, however, observe, that the Culiciform Tipulidæ are certainly the nearest allied to the Culicidæ, and there is evidently a great hiatus between them.

The family CULICIDÆ* (or g. Culex *Linn.*; *fig.* 124. 1. Culex pipiens† ♂) is distinguished from the other Nemocera, by having the parts of the mouth produced into a slender porrected rostrum, which is nearly half the entire length of the insect, and slightly thickened at the tip. This proboscis, simple as it appears, in reality consists of no less than seven distinct pieces‡,

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* BIBLIOGR. REFER. TO THE CULICIDÆ.

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Leach. Descript. of three Sp. Culex, in Zool. Journ. vol. ii.

Fischer. Notice sur la Larve du Culex claviger, in Mém. Soc. Imp. Natur. de Moscow, tom. iv.

Roffredi. Mém. sur la Trompe du Cousin, &c., in Miscell. Soc. Taurinensis, tom. iv. p. 1.

Stephens, in Zool. Journ. vol. i. No. 4. (Culex, Anopheles).

Meigen. Abbild. aller bek. Europ. Zweifl. Ins. Hamm. 1830, Heft 1.

Vollmar, in Gistl's Faunus, No. 2.

And the general works of *Meigen, Macquart, Wiedemann, Fabricius, &c.*

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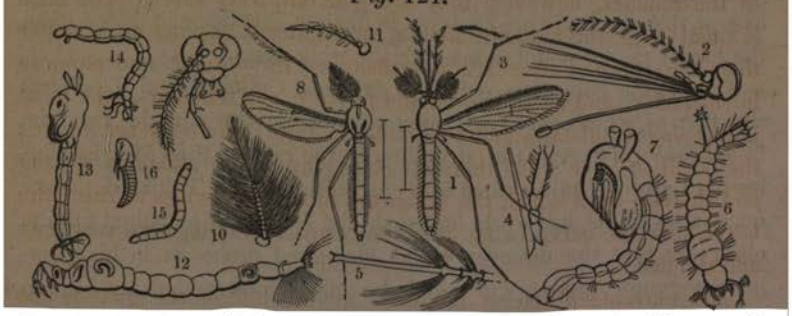
† Mr. Haliday has suggested to me that the gnat of Lapland is the true C. pipiens, and is confined to high latitudes, not being found in England. C. pipiens *Meig.* is quite distinct. C. detritus *Hal.* is nearest allied to the northern species.

‡ Leuwenhoek says four, Réaumur five, Swammerdam and Latreille (in the *Fa-*

Fig. 124.



in the females * (*fig.* 124. 2. head of Culex ♀), besides a pair of several-jointed palpi, which are as long or even longer than the rostrum in some of the males, and very pilose at the extremity;

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milles Naturelles, p. 482.) mention only six, including the labium; he, however, as well as all other entomologists, except Mr. Curtis, have overlooked a very slender needle-like instrument (ribbed up the middle, as it appears to me), which, from its situation, is evidently the real analogue of the tongue: indeed, all the parts of the mouth of a mandibulated insect are here observable, there being a broad and hollow lancet-like piece representing the upper lip (which is the most robust part of the mouth, except the labium), a pair of slender needle-like pieces, or the mandibles, and which are serrated on the outside at the tip (*fig.* 124. 3.); a second pair of similar but much more slender organs, dilated at the base, representing the maxillæ, to the base of which the palpi are attached (*fig.* 124. 4.); the part above mentioned representing the tongue, and the outer tubular canal, in which the others lodge when at rest, representing the lower lip. M. Robineau Desvoidy has published some observations upon these organs, supposing the palpi to be analogous to those of the lower lip, which Latreille has partially controverted in the second edition of the *Règne Animal*. I have succeeded in extricating the maxillæ entire (which are as long as the mandibles, a circumstance not ascertained to be the case in Anopheles by Mr. Curtis), the bases of which are dilated, and have the palpi attached to them.

* It has been observed that it is only the females which are accustomed to suck blood, a circumstance which also occurs in the Tabanidæ. (See Kirby and Spence, *Introd.* vol. iii. p. 343.) And on carefully dissecting the trophi of several males, both of Culex and Anopheles, I have not found the formidable apparatus of setæ so easily discoverable in the females. A horny cylindrical instrument is easily drawn out of the labial canal, and I succeeded in detaching two exceedingly delicate filaments, but I am by no means certain that they are any thing but a portion of the central organ, which seems to represent the labrum of the female, and not to be distinct representatives of the mandibles or maxillæ. M. Curtis, indeed, notices in Culex that the males are destitute of the mandibles and tongue, so that the labrum and maxillæ must be present as well as the labial canal. In Anopheles he has, however, represented the entire series of mouth-organs in the male, figuring, by some oversight, the female palpus apart.

in the females, however, they are generally very short. The head is small; the antennæ are slender and filiform, as long as or longer than the thorax; they are described as 15-jointed * and plumose in the males, and as 14-jointed and pilose in the females, — the basal joint being subglobose and tubercular in form; the eyes are lunate; the ocelli obsolete; the thorax is oblong-oval; the abdomen is long and slender, upon which the wings are incumbent when at rest; the latter have the nervures furnished with scales; the legs are very long and slender.

The extreme irritation produced by the bite of the gnat is too well known even in our own country. The manner, however, in which the operation is effected is interesting: thirsting for its evening meal, the little animal enters our apartments, and instead of whirling, like the moths, round the light, it betakes itself to its employment; sounding an approach, however, by a tolerably loud humming †, which, in our chambers, at least, is often sufficient to banish sleep. Taking its station upon an uncovered part of the skin, with so light a motion as not to be perceptible when it alights (although it will not hesitate to make its attacks occasionally through our thick clothing), it lowers its rostrum and pierces the skin by means of its exceedingly slender needle-like lancets, which are barbed at the tips, and, as by degrees it pushes these deeper into the skin, the lower lip or sheath, in which they were enclosed when at rest, becomes more and more elbowed towards the breast, until the whole length of the

* It appears to me that authors have erred in their computation of the number of joints in the antennæ of the male gnat. By Curtis they are described as 15-jointed (including the large basal joint); that is, as possessing one joint more than the females, there being 12 short joints figured, sueceeding the large basal globular joint and the long penultimate joint; and each of these 12 joints is further represented as verticillate at its extremity. Such is not, however, their real structure, the articulations occurring half way between the several whorls of hairs; the consequence of which is, that the last whorl, instead of being at the apex of the short antepenultimate joint, is at a short distance from the base of the penultimate (13th) joint, which is greatly elongated beyond the whorl: I have clearly ascertained that there is no articulation immediately following the last whorl, the articulation by which the long penultimate joint is moved, occurring half way between the last and the penultimate whorl. Hence the number of joints is alike in both sexes, namely, 14. (*Fig.* 124.5. represents the penultimate and antepenultimate joints of the male antennæ).

† From a calculation made by the Baron Caignard de Latour, communicated to me by M. Audouin, the gnat, during flight, vibrates its wings 3000 times in a minute.

lancets are introduced into the skin. It is supposed that, at the same time, it instils into the wound a venomous liquid, which, while it enables the blood to flow faster, is the chief cause of the subsequent irritation.

The musquito, moustique, or maringouin, which appears to be a species of this family, is far more annoying in its attacks upon the inhabitants of America and India than our European species is to us; it is there requisite to have the beds enclosed in a curtain of fine gauze, to defend the sleeper from their attacks. In the North of Europe, also, they are very tormenting; the inhabitants being under the necessity of driving them away with smoke, and of anointing the exposed parts of their bodies with grease, to secure themselves from their bites.

In the first part of the *Trans. of the Entomological Society*, Mr. W. B. Spence has published a critical examination of a passage in Herodotus, which has much perplexed commentators, relative to the means adopted by the Egyptians * to guard against these insects, known to the Greeks under the name Konopes, the fishermen merely throwing a casting-net (*ἀμφίβλησιτρον*) over the bed. Juvenal and Horace, on the other hand, described the conopeum or gnat curtain.

It appears very probable, that several distinct species, belonging both to the present and following family, have been confounded under the common name of musquito. The musquito of the United States is, however, certainly a species of Culex, for specimens of which I am indebted to Mr. R. H. Lewis. The small Simulium is there called the black fly. Poey also communicated to Robineau Desvoidy a Culex (C. Mosquito *R. D. Monogr.*) known under that name in Cuba. Pohl and Kollar have described the Brazilian musquito under the name of Culex molestus. These authors, however, state that the Portuguese in Brazil also give the name Musquito to a minute species of Simulium.

I must refer, for many curious details relative to the attacks of these insects in various parts of the world, to Kirby and Spence (*Introd.* vol. i. p. 113.), and the *Magazine of Nat. Hist.* 1st series, No. 27.

It is worthy of remark, that notwithstanding the great general de-

* This passage in Herodotus, proving the common occurrence of these obnoxious insects in Egypt, is confirmatory of my suggestion in a previous page as to the musquito being the real cause of the "plague of flies."

licacy of the structure of the gnat, its mouth is formed of the same number of pieces, and upon the same plan, as the equally bloodthirsty but robust breeze-flies (Tabanus). And, as if possessed of the means of insuring them the most ample supply of their favourite food, we find the mouth in these two groups of insects in the highest state of development, no other families possessing so perfectly organised a structure. It is a curious circumstance, however, in the economy of nature, that these and many other species of insects, which delight in blood, are found in the greatest profusion in damp and other situations, where they can find but few opportunities of indulging their bloodthirsty propensities; hence, if they feed at all, their aliment must be supplied from vegetables. The fondness of gnats for the honey of flowers has been noticed by Latreille and other naturalists; and the females, for want of their favourite food, will feed upon the nectar of flowers, as do also the males.

The females have the remarkable instinct to deposit their eggs, by the assistance of their hind legs, in a small boat-shaped mass, capable of floating upon the surface of the water. The eggs are of an elongated oval form, with a small and narrow knot at the top, and are arranged side by side closely packed together. (Réaumur, *Mém.* tom. iv. pl. 44., and Kirb. and Spence, *Introd.* vol. iii. p. 81.) In hot weather the eggs are speedily hatched, and the larvæ (*fig.* 124. 6.) may be generally observed during the spring and summer in standing waters, jerking themselves about with great agility, or suspending themselves for the purpose of respiration, immediately below the surface of the water, head downwards. The head is distinct, rounded, and furnished with two inarticulated antennæ, and several ciliated appendages, which serve them for obtaining nourishment from their food. The thorax is furnished with bundles of hairs; the abdomen is long, nearly cylindric, much narrower than the front parts of the body, and divided into ten segments, the eighth of which is furnished with a long respiratory organ, terminated by a small star (De Geer, tom. vi. tab. 17. f. 5.); the last joint is terminated by setæ, and by five conical slender plates. (See also Réaumur, *Mém.* tom. iv. pl. 43.; Swammerdam, *Book of Nature*, pl. 31, 32.; Kleeman, tab. 15. for the transformations of this family.)

The larvæ are very active, and swim with much quickness, often diving to the bottom of the water, and again ascending to the surface. After several moultings, they are transformed into pupæ

(*fig.* 124. 7.), which continue to move about with agility by means of the tail and two terminal swimming organs. In this state they are active, but unable to take any nourishment; they also suspend themselves at the surface of the water, but in an opposite position to that to which they previously were accustomed; the organs of respiration being placed upon the thorax, and consisting of two tubular horns; the body is much curved, and terminated by two slender oval plates. Here also the insect undergoes its final transformation; the exuviæ of the pupa serving as a raft, upon which it stations itself until its wings are extended. These transformations are effected in the course of three or four weeks, whence there are several generations in the course of the year. The larva of Anopheles bifurcatus (Culex claviger *Fabr.*), as described by Fischer (*ut sup.* Meigen, tom. vi. p. 242., and Macquart, *Suites à B.* tom. i. p. 32.), differs in some respects from that of Culex, having two greyish oval tumours behind the head, and two others, but smaller, near the tail; beneath the latter is a great number of long setæ.

Mr. Stephens has published a monograph upon the British Culicidæ in the *Zool. Journal*, vol. i. No. 4., and M. Robineau Desvoidy an essay upon the family in general, in the *Mém. de la Soc. Hist. Nat. Paris*, tom. iii.

Although so exceedingly numerous in individuals, the number of species in this family is but few, six genera having only hitherto been characterised, three of which only have been noticed as British.

The Culex ciliatus, forming Desvoidy's genus Psorophora, is remarkable for possessing a small appendage at each side of the prothorax.

The family TIPULIDÆ * comprises a very extensive series of insects greatly diversified in structure, corresponding with the Linnæan genus

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Verdat. Geschichte d. Simulien, in Naturwiss. anz. d. Allg. Schw. Gesellsch. 1822, No. 9.; and in Thon's Archiv. vol. ii.

Tipula, and distinguished by the proboscis being very short, its internal organs slightly developed *, and terminated by two large fleshy lips; the palpi longer than the proboscis, 4-jointed and generally folded back: some species have been described as having five joints; it ap-

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And the general works of *Meigen, Macquart, Wiedemann, Haliday, Curtis, Fabricius, &c.*

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* Ordinarily the mouth consists but of a triangular labrum, a bilobed labium, and a pair of maxillary palpi; but in Rhyphus, Ceratopogon, Geranomyia, and Bibio, the labrum is larger and the tongue distinct. In Glochina and Boletophila, the maxillæ also exist; whilst in Sphæromias and Simulium, the whole oral apparatus is found as fully developed as in Culex, except that the parts are shorter.

pears to me, however, from a careful examination of the structure of these organs in Tipula oleracea, that the first or basal joint is the true analogue of the maxillæ. The body is long and slender, the head rather small, the eyes generally apart, the antennæ very variable in length, the legs long and slender; the alulets (owing to the weakness of the flight of these insects) are mostly obsolete. The larvæ vary considerably in form, in order that they may be adapted to their several and peculiar habits. Whilst some of these insects are so closely allied in all their states to the preceding family, that Latreille in the *Genera Crustaceorum*, and Meigen, united the Culicidæ with the present family, others, as Bibio, &c. in their more robust form, short antennæ, &c. evidently approach the succeeding families. The species which appear to be the types of the family are consequently the larger individuals in the family; such as Ctenophora, Pedicia, and the true Tipulæ, which are vulgarly termed Daddy-long-legs. M. Macquart has noticed the curious relation which exists between the characters of the larva and imago, in many of these insects, instancing the occurrence of plumosè antennæ only in those species which live in the water in the larva state, and elongated coxæ only in the species with fungivorous larvæ.

Latreille has divided this family into five minor groups: Culiciformes, Gallicoles, Terricoles, Fungivores, and Florales *; all of which, excepting in the relative situation of some few anomalous genera, appear very natural; their progression, however, appears capable of being rendered more natural by placing the Fungivores immediately after the Gallicoles (the genera Lestremia, Molobrus, &c. forming the passage), by introducing Cordyla amongst the Fungivores, and Lasioptera amongst the Gallicoles, and by uniting the Terricoles with the Fungivores by means of Boletophila.

The subfamily CHIRONOMIDES *Meq.* (Culiciformes *Latr.*) has the body long and slender (*fig.* 124. 8. Chironomus plumosus ♂), the antennæ slender, filiform, and strongly ornamented with hairs, especially in the males (except in Hydrobænus *Fries*, and probably Sphæromias *Curt.*), forming a large triangular brush (*fig.* 124. 10.

* Meigen divided the Tipulidæ into eight sections: 1. *Culiciformes*; 2. *Gallicolæ*; 3. *Noctuæformes* (Psychoda); 4. *Rostratæ* (Terricolæ); 5. *Fungicolæ*; 6. *Lugubri* (Molobrus, *Sciara*); 7. *Latipennes* (Simulium); and 8. *Muscæformes* (Florales). In his last work, M. Macquart has adopted all these divisions except the 6th and 7th, and has added another, consisting of the genus Rhyphus.

ant. of Tanypus ♂); they are much longer than the head, and composed of more than twelve joints, the basal joint being very large; in the female there are fewer and simple joints (*fig.* 124. 11. ant. of Chironomus ♀, 9. Tanypus ♀); the legs are also very long, the ocelli obsolete, and the palpi short; the eyes lunate and separated (*fig.* 124. 9. head, antenna, and proboscis of Tanypus ♀); the tibiæ are simple, and not armed with spines. The nerves of the wings are very similar to those of the gnats; indeed, so close is the general resemblance between the structure and habits of the two groups, that they have been regarded as belonging to the same family, and have been in common parlance confounded under the name of gnats. This term, however, ought to be applied only to the true Culicidæ, and the name of midge assigned to those insects of the present family, which are of small size, and, like the gnats, often assemble in immense cloud-like swarms, and perform aerial dances, composed for the most part of males. The eggs are deposited in a mass, and not arranged as in the Culicidæ. Their larvæ also mostly reside in the water, and greatly resemble those of the Culicidæ. Some of them are furnished with pediform appendages, and in some the extremity of the body is furnished with tentaculæ; these are generally of a red colour.

The pupæ also mostly dwell in the water, respiring by means of external tubes or filaments, situated in front of the body, and possessing the power of swimming; these pupæ offer a marked difference from those of the true incomplete pupæ, their legs, from their great length, being partially convoluted, and forming, with the wings and thorax, an uniform mass, the limbs being less distinct even than in the obtected pupæ of the Lepidoptera. De Geer (*Mém.* tom. vi. tab. 23. fig. 3—12.) has represented the transformations of a species which is described by Latreille as the Corethra culiciformis, the larva and pupa of which are almost identical in structure with those of Culex. I fear there must have been some error either in De Geer's observation or in Latreille's synonyme, inasmuch as Réaumur's figures of the transformations of a species described as Corethra plumicornis (*Mém.* tom. v. pl. 6. fig. 4—18.) totally differ from De Geer's, the larva being very long and serpent-like, rather thickened in the thoracic segments; the head small, conical, and turned upwards, furnished with two deflexed hooks articulated at the tip, and two short tentacular palpi; the body is terminated beneath with a beautiful fan of hairs (figured by Réaumur as a membranous plate). The pupa is some-

what like that of the gnat, but it is straight, and the thoracic appendages are pointed. Goring and Pritchard have figured this larva (my *fig.* 124. 12.) and pupa (*fig.* 124. 13.), but have unfortunately omitted the imago. (*Nat. Hist. Obj. Microsc.* pl. 2.) These authors assert that the larva does not shed its skin on becoming a pupa, and have made some other erroneous statements, such as confounding the sexes of the perfect insect, &c. Slabber (*Natuurk. Verlustig.* p. 17. pl. 3, 4.) and Lyonnet (*Mém. Posth.* pl. 7. fig. 3, 4. 8. 14. 18., &c.) have also figured the transformations of a Corethra similar to those of Réaumur. Lyonnet has further noticed that the eggs are arranged in great order, being on a kind of convex disc; they are, however, laid on their sides, and arranged in circles.

The larva of Tanypus maculatus *Meig.* (according to Latreille, *Gen. Crus.* tom. iv. p. 248.), figured by De Geer (tom. vi. pl. 24. fig. 15—19.), resembles Réaumur's figure of the larva of Corethra, except in being less elongated, with a more oval head, the thorax having at its base beneath a long pediform bifid tentacle, and the extremity of the body is terminated by four minute triangular plates, with two long pediform appendages beneath and two slenderer ones above, with long terminal hairs. The pupa is like that of Culex, and bent, but with broader oval thoracic appendages, and the anal plates small. Macquart (*Hist. Nat. Dipt.* tom. i. p. 43.) has described some larvæ closely resembling the last, which he also regards as those of a species of Tanypus. Lyonnet has figured the transformations of another species of Tanypus (*Mém. Posth.* pl. 17. fig. 1, 2. 5, 6. 17., &c.), the larva of which forms for itself a movable case of silk and moss spun together. Fries has also observed the transformations of Tanypus varius; the eggs of which are deposited by the female on the leaves of aquatic plants, and covered with a mass of gluten. The larvæ and pupæ do not differ from those figured by De Geer.

The larvæ of Chironomus plumosus (figured by Réaumur, tom. iv. pl. 14. fig. 11, 12., and tom. v. pl. 5., and my *fig.* 124. 14.) are very vermiform, and of a blood colour, whence they are named blood-worms; they are found in stagnant water, and are very active, twisting about in all directions. The head has two ocelli-like points, and two biarticulate palpi, observed by Macquart; beneath the first thoracic segment are two short pediform tentacles; the extremity of the body has also two still larger, and four small oval appendages; each of the two preceding joints is furnished with a pair of long fleshy filaments. These larvæ as-

semble in a mass, and form tortuous tubes, which unitedly compose an irregular mass at the bottom of the water, formed of particles of decomposed leaves: those which he has figured (vol. iii. pl. 14. f. 11—16.) appeared to have been chiefly spun. The pupa differs from that of the preceding genera, by having five long, slender, and pilose filaments on each side of the thorax, and the abdomen is terminated by a thick pencil of hairs.*

De Geer has figured (*Mém.* tom. vi. t. 22. f. 14—20., t. 23. f. 1, 2.) the transformations of another species, which is referred by Macquart to the Chironomus stercorarius *Meig.*, the larvæ and pupæ of which entirely differ from that of C. plumosus in structure, as well as in the place of their abode, the larva residing in dung, and being perfectly cylindrical (my *fig.* 124. 15.), without any filamentous or tubercular appendages, and the pupa (my *fig.* 124. 16.) of the ordinary incomplete form, without any thoracic or anal filaments or lobes, and the feet not confined to the body. In these respects, therefore, this insect evidently belongs to a genus distinct from Chironomus (if, indeed, there be not some error in De Geer's observation).

The genus Ceratopogon, placed in this subfamily by Meigen and Macquart, is removed to the following by Latreille; its transformations, indeed, totally vary from those of the Culiciformes, with which, however, it agrees in having the male antennæ partially feathered. M. Guérin has observed the transformations of two of the species† (*Ann. Soc. Ent. de France*, vol. ii. pl. 8.); the larvæ (*fig.* 125. 1.) are cylindric, with the segments rather constricted, the anterior part of the body rather thicker; the head is small and retractile; each segment of the body is furnished on the back with two clavate setæ; these larvæ are not aquatic, but were found under the damp bark of dead trees; the pupa (*fig.* 125. 2.) is shorter than the larvæ, and much broader in front, with two short lateral appendages. The cast skin of the larva partially

* The genus Hydrobænus *Fries* (*Kongl. Vetensk. Acad.* 1829, tom. ix., and *Isis*, 1831) has the male antennæ not plumose; its larva, however, closely resembles that of Chironomus plumosus, but the penultimate segment has two dorsal filaments with long terminal hairs, and the pupa is figured without the thoracic filamentous setæ.

† Mr. Haliday informs me that Ceratopogon geniculatus *Guer.* (which he has also reared) is C. bipunctatus *Lin.*; and that he has reared C. trichopterus from larvæ (much more hairy) found under boleti on old planks; adding that Guérin's figure, though exact enough as to general character, does not express the specific character of the larva very well, but the figure of the imago discriminates it.

serves as a covering for the abdomen of the pupa. The larva and pupa of Ceratopogon lateralis, figured by Bouché (*Naturg.* tab. 2. f. 1—12.), (the former of which was found in rotten manure), differs in several respects from Guérin's description, especially in the larva wanting the clavate setæ, but possessing two pediform appendages to the prothorax and anal extremity; the pupa has also eight long filiform appendages on the back of the thorax, which serve to represent those at the side of the thorax of the Chironomi. Some of the minute species of Ceratopogon have the habit of inflicting very sharp wounds in the naked skin with their proboscis, sucking blood as greedily as the Culicidæ; and in the allied genus Sphæromias *Curt.* all the parts of the mouth are as perfectly developed as, although shorter than, in the Culicidæ. (See also Fischer's *Oryctograph. Gouvernm. Moscou*, for a memoir on Ceratopogon.)

The second subfamily, Cecidomyides (Gallicoles *Latr.*), is distinguished by the antennæ being for the most part more or less moniliform, especially in the males (*fig.* 125. 3. Cecidomyia lutea? ♂;

Fig. 125.

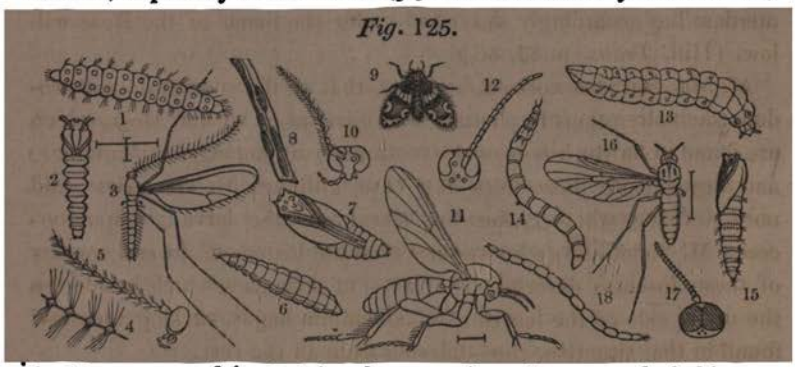


fig. 125. 4. part of its 24-jointed antenna), and composed of thirteen joints at the least (*fig.* 125. 5. head and antenna of Cecidomyia ♀), and simply ornamented with a few short verticillate hairs; the legs are long, and not armed with spines, the basal joint of the tarsi very minute, the eyes lunate, the ocelli wanting; the wings furnished with but few nerves, and either carried flat on the back or roof-like when at rest. These insects are of very small size, residing in their preparatory states in gall-like excrescences, which they produce upon various plants; thus, as well as in their minute size, and the almost veinless wings, offering a striking analogy with the true Hymenopterous gall-flies (Cynipidæ). Their larvæ being terrestrial, are not furnished

with the exserted organs of respiration so remarkable in the larvæ of the preceding subfamily. According to Stannius, their spiracles are arranged as in the fungivorous larvæ.* (*Observ. Mycetophila*, p. viii.)

The species of the genera Cecidomyia and Lasioptera are very numerous, inhabiting many different plants, some depositing their eggs in the young sprigs, others in the leaves, and others in the flowers, causing thereby either the production of galls similar to those produced by the Cynipidæ, or the distortion of the flowers. De Geer has represented the transformations of several species (*Mém.* tom. vi. pl. 25, 26, 27.), including Lasioptera Juniperi, and Cecidomyia Loti and Pini, the larvæ of which (*fig.* 125. 6.) are fleshy oval grubs, rather attenuated in front, without any exserted appendages, except that of L. Pini, which has short rudimental feet (which Bouché, however, did not find); the pupæ (*fig.* 125. 7.) resemble the imago, except in being of a much more contracted form, with the wings and legs very short and resting upon the breast, in distinct cases. One of the species produces galls on the willow, which Swammerdam has accordingly described under the name of the Rose-willow. (Hill, *Trans.* p. 85, 86.)

M. Macquart has noticed, however, that all the species do not produce such alterations in plants. The larvæ of C. bicolor *Meig.*, which are found upon the leaves of the mothwort, are amongst this number; and they enclose themselves in a case, although M. Macquart could not determine whether this was the skin of the larva or a spun cocoon. M. Vallot also (who has observed the history of several species of these insects) describes the larvæ of a species, which reside on the under side of the leaves of Chelidonium majus, sucking the acari found in that situation, thus differing from all the rest.

Some of the species in this genus are extremely injurious to the wheat crops both in England, Europe, and North America. Mr. Kirby has given ample details of the economy of one species, C. Tritici *K.* (*Linn. Trans.* vol. iii. iv. and v.), the eggs of which are deposited by the female in the centre of the corolla, where the larvæ when hatched, perhaps by eating the pollen, prevent the impregnation of the plant, and thus destroy a considerable portion of the crop. Another species, still more destructive, known in America under the name of the

* Stannius noticed the curious connection which appears to exist in these two groups of insects — between the possession of spiracles along the sides of the bodies, and their habits of spinning a cocoon.

Hessian fly," has been described and figured by Say, under the name of C. destructor; it attacks the lower part of the stem of the plant. When full grown, it becomes a pupa enclosed in a covering, at which time it is known under the name of the flax-seed state (*fig.* 125. 8.). It is not described in what manner this case is formed. The species differs in this respect materially from its congeners. (See also Dryander's *Catal. Library Banks.*) The same, or a closely allied species, has been observed by Dr. Hammerschmidt of Vienna, by whom specimens were forwarded to M. Lefebvre, who presented them to me. (See Kollar's *Treatise on Injurious Insects,* transl. p. 118.) On opening some of the cases, I discovered the larvæ enclosed dead, and in a shrivelled state.

Another species, T. pennicornis, effects the impregnation of the flowers of Aristolochia (Willdenow, *Grundr. d. Krauterkunde,* p. 353., *Introd. to Ent.* vol. i. p. 298., and *Ann. Med. Rev.* vol. ii. p. 400.). M. V. Audouin has communicated to me an observation made by himself on a species which lives in the leaves of Buxus — ?, the pupa of which pierces the epidermis of the leaf, thrusting the front of the body into the air immediately before assuming the perfect state. It is difficult to conceive how the delicate species which are bred in the hard woody galls make their escape.

I regret that want of space will only permit me to notice the following additional memoirs upon various species of Cecidomyia: L. Dufour on C. Ericæ (in *Ann. Soc. Ent. de France,* 1837, p. 83., and in ditto, 1838, p. 293., *C. Pini maritimæ*); Bouche's descriptions of the larvæ and pupæ of several species, in his *Naturgeschichte* (tab. 2.); Vallot on Cecidomyia Poæ; and its parasite, in the *Ann. des Sci. Natur.* July, 1833; Géné, on C. Hyperici, in the *Trans. of the Turin Acad.* vol. xxxvi.; P. F. H. Baddeley, Esq., on an East Indian species of this genus which produces a kind of gall on the leaves of Ficus racemosa, illustrated by beautiful figures in Corbyn's *India Review,* No. 7. Oct. 15. 1836; Drewsen in *Ann. Sc. Ent. de France,* 1835, p. lxii.

The singular genus Psychoda (forming the tribe Phalænoides *Mcq.*) composed of minute species, with broad, deflexed, and very hairy wings (*fig.* 125. 9—10. head and antenna), often found on windows, although agreeing with this subfamily in the elongated antennæ, composed of globular verticillated joints, differs in the greater number of the veins of the wings. The larva of P. Phalænoides, figured by Bouché (*Naturgesch.* tab. 2. f. 20.), resides in dung; it is long, sub-

fusiform, depressed, with a slender, straight, cylindrical tail, longer than the preceding segment. The pupa has two short appendages, thickened at the tips behind the head; the abdomen is tapering. Mr. Thwaites has found the pupa of another species of this genus in a dead snail's shell. *

One of the species of this genus, first noticed by Latreille and Dufour, is remarkable for possessing two appendages at the front of the thorax, and which Latreille considered as analogous to the prebalancers of the Strepsiptera. Mr. Haliday since detected them in a species which he thence named P. auriculata, and Mr. Curtis suggests that they are accidental, and appear to him to be the analogues of the appendages of the pupa. Robineau Desvoidy also described one of the Culicidæ with somewhat similar appendages.

The subfamily MYCETOPHILIDES *Mcq.* (Fungivores *Latr.*) consists of insects of small size (*fig.* 125. 11. Mycetophila punctum *Stann.*), distinguished by having two or three unequal-sized ocelli (*fig.* 125. 12. head and antenna of Sciophila); the eyes are generally round; the head not rostrated; the antennæ slender, 15- or 16-jointed, and longer than the head, or compressed, never fasciculated; the last joint of the palpi is of moderate length, not ringed; the coxæ are elongated; posterior tibiæ spined, and mostly with strong spurs; the nerves of the wings are not so numerous as in the following insects.

This subfamily is composed of extremely active insects, capable of leaping by means of their hind legs. They are particularly found in damp situations, amongst various plants; many species enter our

* The following is the description of the pupa which Mr. Thwaites has been so kind as to send me, and which is a line and a quarter long.

"Head resting between the anterior femora and tibiæ; the antennæ embracing the exterior of these, and reaching to the apex of the tibiæ; thorax with a strong central keel extending from the head to the metathorax (?), which is smooth; the thorax is also furnished anteriorly with two horn-like appendages (analogous, I presume, to the breathing pores of the pupa of Culex), slightly diverging and curved a little forwards, which arise from tubercles half way between the carina and the origin of the wings; posterior tarsi reaching almost to the apex of the wings, merely the last joint is visible, the rest being concealed by the intermediate legs, and these last are covered, except about two joints of the tarsi, by the anterior legs; abdomen with a row of pointed tubercles down each side; the dorsal segments are nearly smooth, the last slightly bifurcate, the ventral segments with a row of small sharp spines just above their edges, the anal segment with two rather large spines."

houses, and are found on the windows. They are also very partial to different species of boleti and fungi, in which the larvæ reside.

The larva of *Ceroplatus tipuloides*, observed by Réaumur (*Mém.* tom. v. tab. 4. f. 11—18.), on the under side of the Boletus angulatus, is completely vermiform, hyaline, and always covered with a viscid secretion. It spins a web, in which it invests itself; and it is in the same situation that it assumes the pupa state. The larva of another species of this genus, observed by Bosc in Carolina, is gregarious; living in a common web, upon the under surface of a boletus; and each spins a close cocoon, in which it assumes the pupa state. (Latr. *Hist. Nat., &c.* tom. xiv. p. 281.) More recently M. Dufour has communicated to the "Académie" a memoir on this genus, containing a complete account of the habits, transformations, and anatomy, and descriptions of five species. (*Révue Zool. Soc. Cuvier.* 1839, No. 4.)

De Geer has figured the transformations of two species of *Mycetophila* (M. agarici and fusca, *Mém.* tom. vi. tab. 21. f. 6—13., and tab. 22. f. 1—13.). The larvæ of both are vermiform, the former being more elongated, and enclosing itself in a silken web; the latter (*fig.* 125. 13., which lives in Boletus luteus) is thicker, with a small head, bearing two short antennæ, and the body furnished with two spiracles on the prothoracic, and two on each of the seven basal joints of the abdominal part of the body.* Bouché has also figured the transformations of Mycetophila signata *Meig.* (*Naturg.* tab. 3. f. 5—9., representing the mandibles of the larvæ as armed with several short sharp teeth.

The larvæ of *Boletophila*, described by Guérin (*Annal. Sci. Nat.* Aug. 1827, and *Bullét. Sci. Nat.* Jan. 1829), live in society, in the interior of fungi, like those of the Mycetophilæ; the head is furnished with two short membranous antennæ and two hooked mandibles; they undergo their transformations in the earth; the pupæ have the limbs

* Dufour has also observed this in various fungivorous larvæ (see *Rév. Zool. Soc. Cuvier.* 1839, No. 7.); and Meigen observed the same in Mycetophila fasciata (*Syst. Beschr.* vol. i. p. 261.). Stannius observes, that Mr. MacLeay, overlooking this description, has erred in asserting that this arrangement of the spiracles is not found in any Dipterous larva. The same author also, relying upon the veining of the wings, states that the fossil insects, figured by Curtis (*Edinb. New Phil. Journ.* 1829, tab. 6. f. 8, 9.) as species of Gnoriste, belong to the genus Mycetophila; one being closely allied to M. propinqua, and the other to M. lateralis. (*Obs. de g. Mycetophila*, Introd. p. vii.)

enveloped in distinct segments, applied loosely to the under side of the body. Guérin has observed that the mouth of this genus is furnished with maxillæ, as well as the labrum and labium. I have confirmed this in the figures published by Mr. Stephens. (*Illustr. Brit. Ent. Haust.* pl. 44. f. 1.)

M. Macquart has reared Mycetobia pallipes from larvæ of the ordinary form, found in the detritus of elm wood; whilst Meigen obtained M. fasciata from larvæ found in Boletus versicolor. Lyonnet has figured the transformations of an insect which De Haan gives, doubtingly, as a species of Bibio; but which appears to me, especially from the nervures of the wings, to be a species of Mycetobia. (*Rech. Posth.* tab. 17. fig. 20—33.) The larva (*fig.* 125. 14.) is very long, slender, and vermiform, with two very short antennæ; and the pupa (*fig.* 125. 15.) is straight, and has the abdominal segments armed with transverse series of short reflexed spines. Guérin has figured the pupa of one of the species of this genus (*Iconogr. R. An. Ins.* tab. 93. f. 5.).

I have observed the transformations of several species of Molobrus *Latr.* (Sciara *Meig.*), the larvæ and pupæ of which are found under the bark of felled trees, or at the roots of decayed vegetables; the pupa is not enclosed in a cocoon. Olivier reared three species of this genus from wheat (*Prem. Mém. sur quelques Insectes qui attaquent les Céréales*, 8vo, Paris, 1813, f. 7, 8, 9.). Bouché has also figured the larva and pupa of Molobrus vitripennis (*Naturg.* tab. 3. f. 10—15.); the former of which agrees precisely with that of Mycetophila, whilst the latter differs only in the front of the head being cleft and the tail furnished with two divergent setæ. The Tipula atomaria (De Geer, *Ins.* tom. vii. tab. 44. f. 27, 28.) is apterous, and appears to me to be most closely allied to Molobrus; its antennæ are rather long, 15-jointed, the joints not being filiform. Macquart considers it as belonging to the section Gallicoles, and St. Fargeau to the Terricoles, from its possessing an exserted ovipositor.*

The genus Rhyphus (*fig.* 125. 16. R. fenestralis ♀), although differing in several material respects, is also nearly allied to this subfamily, especially in the possession of ocelli (*fig.* 125. 17. head of ♂), and structure of the larva (*fig.* 125. 18.), which Réaumur found in cow-dung; it is very long and cylindric, the mouth armed with two tentacular mandibles, and the extremity of the body with four short

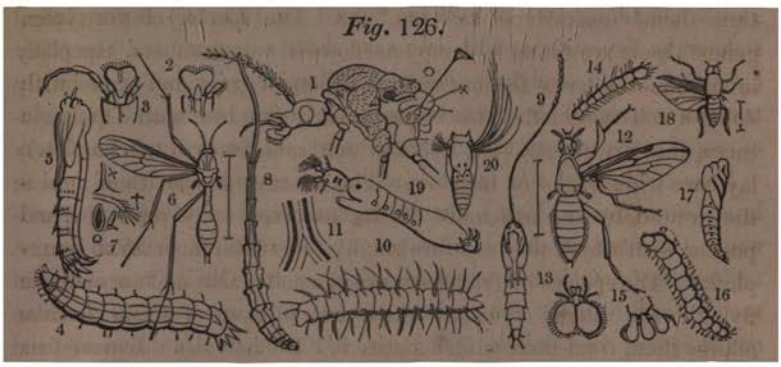
* See Mr. Haliday's observations hereon in the Generic Synopsis.

very small obtuse tubercles. (*Mém.* tom. v. tab. 4. f. 3—10.; Bouché, *Naturgesch.* tab. 3. f. 21, 22.; Guérin, *Icon. R. An. Ins.* tab. 93. f. 3.) Macquart forms it into a distinct tribe named Rhyphides.

Whilst the Molobri, Lestremia, and some other genera exhibit a passage from these insects to the Cecidomyides, others equally appear to lead to the Tipulides. I have accordingly removed this subfamily into its present situation; whereas Latreille placed them between the Tipulides and Bibionidæ.

The subfamily Tipulides *Mcq.* (Terricoles *Latr.*) is distinguished by the large size of the majority of the species of which it is composed (*fig.* 126. 6. Ptychopteryx paludosa ♀), having the antennæ longer

Fig. 126.



than the head, simple or rarely pectinated*, but not plumose, and composed of from thirteen to sixteen joints; the eyes entire; the ocelli obsolete; the front of the head produced into a beak, often terminated in a pointed nasus, distinct from the proboscis; the palpi long, 4-jointed, and reflexed; the last joint longer than the preceding, and often flexible and ringed (*fig.* 126. 1.† head and thorax of Tipula oleracea sideways; 2. proboscis above, showing

* In the New Holland genera, Gynoplistia and Ptilogyna *Westw.*, the females have the antennæ pectinated as well as the males.

† In *fig.* 126.1. the dotted part represents the mesothorax, showing the almost rudimental collar-like prothorax, behind which is a spiracle; another spiracle is placed close to the base of the balancer of the metathorax, of which the dorsal piece, marked ×, is here very conspicuous, especially in some species, and might (from its situation, occupying the dorsal extremity of the thorax) be supposed to represent the scutellum of the following families. It is, however, in consequence of the great elongation of the body that the metathorax is here longitudinally developed, and hence the part of the dotted mesothorax marked O, appears to me clearly to represent the scutellum of the following families.

the small triangular labrum; 3. proboscis beneath, with one of the 4-jointed palpi, showing its origin obliquely upon a short basal piece which has been ordinarily regarded as a basal joint, but which appears to me to represent the maxilla; its texture is different to that of the palpus); the body, wings, and legs are long, the nervures numerous, and forming discoidal cells. The wings are wanting in Dalman's genus Chionea. In Eriioptera atra *Meig.* (Molophilus brevipennis *Curt.*), for specimens of which singular insect I am indebted to M. Meigen himself, the wings are so short as to be unfitted for flight.

This subfamily comprises the typical species of the family to which the vulgar name of Daddy-long-legs has been applied; the French term them "couturières, tailleurs," &c. The species of the typical genus Tipula are found in damp meadows in vast numbers, especially in autumn, the larvæ feeding upon the roots of grass, and occasionally doing much mischief. This is particularly the case with Tipula oleracea, the larvæ (*fig.* 126. 4.) of which sometimes thus completely lay bare wide tracks of meadow. The females deposit their eggs in the ground by the assistance of the exserted scaly plurivalve ovipositor with which they are furnished. (See Réaumur, *Mém.* tom. v. pl. 2.) The species of Trichocera are of smaller size, and are observed flying in the middle of winter whenever a glimpse of warm sunshine allures them from their winter-quarters. Dalman also discovered the singular Chionea* araneoides running quickly upon fallen snow in Sweden throughout the winter. (*Act. Holm.* 1816, p. 182., and *Anal. Entomol.* p. 35.)

The larvæ of many species reside in damp ground, or in the rotten parts of trees (*fig.* 126. 4.); they have the thoracic portion not so distinctly observable as in some other species; they are not furnished with false legs, but have two short horns at the anterior, and several fleshy conical appendages at the posterior extremity of the body; the mouth is composed of parts which have some analogy to those of the Mandibulata, but their structure requires a more precise investigation than has been given to it. The pupæ (*fig.* 126. 5.) are naked, with two respiratory tubes near the head, and the margins of the abdominal segments are spiny, enabling them to thrust themselves forward to the surface of the ground when ready to assume the winged state.

* I am indebted to Dr. T. W. Harris, the celebrated American entomologist, for an undescribed species of this remarkable genus, found, but very rarely, in New Hampshire (U.S.). My specimen is a female, with an ovipositor, like Tipula; Dalman represents a male. (*Act. Holm.* 1816. tab. 2.)

The larvæ and pupæ of various species of Ctenophora and Tipulæ which agree with the above description, have been observed by Réaumur (*Mém.* tom. v. pl. 1—3.); De Geer (tom. vi. pl. 18, 19. and 25.); Fischer (*Oryctographie Imper. Rossiæ*); Bouché (*Naturgesch.* tab. 2. f. 24—29., tab. 3. f. 1—4. Tipula pratensis); Rösel (*Abhandl.* vol. ii. *Musc. et Culic.* tab. i.).

I have several times observed battles taking place between males of different species of Tipula.

The larvæ of Limnobia* xanthoptera and pilosa inhabit species of Agaricus (Stannius, *Beitr. Entomol. Schles.* vol. i. p. 202.); they offer no marked peculiarities of structure; the pupæ also are of the ordinary form, without elongated appendages to the thorax (tab. 5. fig. 14.).

M. Van Roser has noticed several larvæ of this and allied genera (*Verz. Wurtemb. Dipt.*); that of the curious genus Anisomera resembles that of Tipula, and is commonly found by him under the sand of the banks of the Neckar.

All the larvæ of this family are not, however, terrestrial, the preparatory states of several groups being undergone in water; of these the genus Ptychopteryx (*fig.* 126. 6. Pt. paludosa†) exhibits a singular departure from the rest of the family; the larva (*fig.* 126. 8.) being very long and worm-like, but much narrowed at the posterior extremity, which is terminated by a very long and delicate tube serving to convey the air to two tracheæ, which extend through the entire length of the body. In the pupa (*fig.* 126. 9.) this peculiarity is reversed, the body being terminated by four small points, whilst the anterior extremity is furnished with a very long thread-like appendage serving, like the former, to supply air to the insect, its extremity being extended to the surface. Lyonnet has beautifully illustrated the transformations of P. paludosa (*Rech. Posth.* pl. 18. f. 1. 7.);

* See *Ann. Soc. Ent. France*, 1836, p. xviii. on a fossil Limnobia found at Dalmarnock.

† The species of this genus possess a remarkable peculiarity in the imago state, which I have observed in no other insect of the family, and which does not appear to have been previously noticed, namely, the possession of two minute membranous and setose appendages between the base of the balancers and metathoracic spiracles. (*Fig.* 126. 7. x base of the balancer; 0, metathoracic spiracle; †, the above-mentioned appendage.) The discovery of this appendage throws further difficulty in the way of the solution of the question, whether the halteres be the real representations of the hind wings.

Réaumur, however, had long previously figured the pupa (*Mém.* tom. v. pl. 6. f. 1, 2, 3.).

De Geer has also described and figured (*Mém.* tom. vi. pl. 20.) the transformations of another remarkable species (which also resides in the water), which appears to have been overlooked by all subsequent authors, although sufficiently proving that the species in question (Tipula replicata *Linn.*, placed by Macquart in the genus Limnobia) belongs to a distinct genus. The larva (*fig.* 126. 10.) resembles those of the water moths Hydrocampa, in having the body furnished with numerous long filamentous processes which evidently appear (from his fig. 7. and my *fig.* 126. 11.) to be internally supplied with air-tubes. The pupa is also remarkable on account of the singular apparatus of hooks upon the back of the three or four terminal abdominal segments; the imago is also peculiar from its habit of having the hind margin of the wing folded back upon the anterior part.

De Geer has likewise figured (*Mém.* tom. vi. tab. 24. f. 1—14.) the transformations of another species, which has also been neglected by subsequent writers, the larva and pupa of which bear a much closer resemblance to those of the Culicidæ than to the Tipulides; the tail of the larva is, however, singularly furnished with lobes and setæ; the imago, judging from the general form and veins of the wings appears to me to belong to the genus Dixa.* The species is named Tipula amphibia in the German edition of De Geer.

The subfamily, BIBIONIDES *Macq.* (Florales *Latr.*) is distinguished from all the other Tipulidæ, by having the body and legs shorter and more robust (*fig.* 126. 12. Bibio Marci ♀); the antennæ (*fig.* 126. 14.) seldom longer than the head in both sexes, thick, cylindric, moniliform or perfoliated, and composed of from eight to twelve joints; the wings are large; the eyes in the males are large and generally contiguous (*fig.* 126. 13. head of Bibio ♂); the palpi are 4-jointed except in the genus Scatopse, in which they are described as possessing but a single joint; the tarsi in Bibio have three pulvilli (*fig.* 126. 15.).

* Mr. Haliday has confirmed this opinion; suggesting to me that De Geer's species is Dixa cincta. The same gentleman has also communicated to me a figure of the larva of the winter midge, Trichocera hiemalis; it closely resembles my *fig.* 124. 15., except that the hind extremity of the body is much more acuminated, and terminated by five small conical points; and the head oval, with two very short lateral lobes. The species whose mode of extrication from the pupa-case is described in the *Mag. of Nat. Hist.* for February, 1840, by J. B., is a species of this genus, the author having forwarded me a specimen.

This family is of much smaller extent than the preceding; the insects are of small or moderate size, and their flight is slow and heavy; the fore feet in the genus Simulium are kept in a continual movement, being evidently employed as feelers. In their general appearance they entirely differ from the rest of the family, approaching the following tribe. The species of the genus Bibio are remarkable for the great diversity in the opposite sexes; the larvæ in this genus (*fig.* 126. 16.) are cylindrical worms furnished with twenty spiracles, and with transverse rows of short hairs, which serve as points to assist in progression, being destitute of feet; they are found in dung. I have found them in garden earth at a short distance from the surface, the pupæ enclosed in smooth oval cells; the pupa (*fig.* 126. 17.) is naked, and has the thorax very gibbose, with the rudimental wings and legs very short. (Réaumur, *Mém.* tom. v. pl. 7.; and De Geer, *Mém.* tom. vi. pl. 27. fig. 12—20.; Bouché, *Naturg.* tab. 4. f. 1—10.; Rösel, *Abhandl. Ins.* vol. ii. tab. 7. *Musc.*) Lyonnet has given a complete illustration of Bibio Marci in its different states (*Mém. Posth.* pl. 7.). Mr. Haliday (*Ent. Mag.* vol. i. p. 179.) has made some interesting observations on the unequal numbers of individuals of the different sexes of these insects.

The species of Scatopse are of small size, and are found in outhouses, privies, &c.; their larvæ are long fusiform grubs, without feet, having two short points at the sides of the prothoracic and eight basal abdominal segments; the body is terminated by two elongated divergent setæ. (Bouché, *Naturg.* tab. 3. fig. 16—19.). Mr. Walker (*Ent. Mag.* vol. iii. p. 406.) notices having observed myriads of one of the species hovering and settling on a larch tree in October.

The species of Simulium are also of small size (*fig.* 126. 18, S. reptans ♂) regarded by Curtis as forming a link between the last-named insects and Molobrus, but appearing to me to be much nearer allied to Ceratopogon, and perhaps, also, as suggested by Fries, to Cordyla. They are found in damp marshy places, flying in great swarms; and as all the parts of the mouth are fully developed (as ascertained by Curtis), they are enabled to inflict a very severe wound; in fact, some of the species are amongst the greatest torments to mankind, as well as to domestic animals. According to Schonbauer one of the species (Rhagio Columbaschensis *F.*) is one of the greatest scourges to man and beast in the Bannat of Temeswar in Hungary.*

* See Schonbauer's *Treatise*, above referred to, and Kollar's *Treatise on Injurious Insects, translated*, p. 68.

Fries also describes the molestations caused by these insects in Lapland, whilst Pohl and Kollar have described a Brazilian species equally obnoxious. These authors state that it is called a musquito by the Portuguese Brazilians; in North America, however, as I learn from Mr. R. H. Lewis, it is distinguished from that insect, and known under the name of the Black Fly.

The transformations of S. sericeum have been observed by Fries and Verdat; they are aquatic, living on the stems of Phellandrium and Sium. The larvæ (*fig.* 126. 19.) are cylindric, rather slenderer in the middle of the body, with the head distinct, furnished in addition to the trophi, with two short antennæ and two singular flabelliform appendages; the thoracic part of the body has a thick conical and retractile tubercle beneath; the extremity of the body has also several curved appendages; the pupa (*fig.* 126. 20.) has on each side of the front of the sides of the thorax eight very long filiform appendages, arising in pairs analogous to the appendages of the pupa of Chironomus; the posterior part of its body is enclosed in a semioval membranous cocoon attached to the plants and open in front *; the imago is produced beneath the surface of the water, its fine silky covering serving to repel the action of the water.

The genus Aspistes is remarkable for having its short antennæ clavate at the tips. Some account of its history is given by Meigen (vol. vi. p. 317.).

The second general division of the first section of the Diptera is composed of species in which the antennæ do not consist of a regular series of ordinary-sized joints; and corresponds with the Brachocera of Macquart, after the removal of the Pupipara. It consists of the three stirpes Notacantha, Tanystoma, and Athericera; the antennæ of which are generally shorter than the head, having the terminal joints either articulated in an indistinct manner, or completely soldered together into a mass terminated by a seta, which has at its base one or two

* From observations which M. V. Audouin has communicated to me as to the formation of this cocoon, it appears that it is at first formed entire by the larva, and that the upper end is afterwards eaten away as far as a thickened arch previously formed; the object of this contrivance is evidently to allow the action of the water upon the long filaments of the pupa, which are thus shown to be air-tubes.

short joints, and is sometimes simple, sometimes hairy. This seta is the evident representative of several of the terminal joints of the antennæ of the preceding Diptera. The palpi have never more than two or three joints.

The second stirps of the order Diptera, NOTACANTHA, is distinguished by having the antennæ composed of a number of articulations, the terminal ones being closely united, so as to form an elongated mass (*fig.* 127. 3. 7. 13.), which has been considered by Latreille merely as the third joint; the proboscis encloses only four internal organs at the most, but even these in some species are more or less obsolete; the palpi are minute and clavate; the wings fold upon each other over the abdomen, and the scutellum is generally spined; the wings have a central cell, emitting several very indistinct longitudinal nerves, which mostly run to the tips of the wings. These insects are generally gaily coloured, and found in moist situations, it being in such habitats that the larvæ reside; these undergo a coarctate kind of metamorphosis, in which, however, the skin of the larva retains its form, instead of contracting into a "boule allongée."

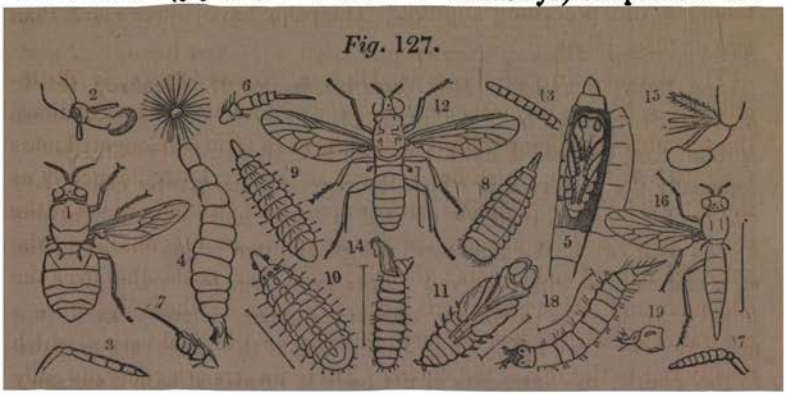
Latreille, in the second edition of the *Règne Animal*, guided by the formation of the antennæ, considered the Mydasidæ as referrible to this stirps. It appears to me, however, from their general structure, and especially from the peculiar neuration of their wings (which closely resembles that of some Nemestrinæ belonging to the Anthracidæ, especially Nem. fasciata *Meig.* vol. vi. tab. 66. fig. 5.), that the Mydasidæ belong to the stirps Tanystoma. The tarsi of Mydas, moreover, have only two pulvilli.

This stirps is divisible into two families, the Stratiomidæ and Beridæ; the latter of which, in general appearance, colours, sluggish manners and habits, nearly approach the terminal Tipulidæ.* Mr. Stephens, indeed, makes the Asilidæ the connecting link between the Tipulidæ and the rest of the Tanystoma, but I can see no grounds for such an approach. Meigen, on the contrary, followed by Curtis, has placed the Beridæ (including Xylophagus and Cænomyia) between the Tipulidæ and Tabanidæ, but has removed the Stratiomidæ (whose affinity with the Beridæ appears to me unquestionable) to the vicinity of the Syrphidæ.

* I nevertheless place the Beridæ after the Stratiomidæ, in order to maintain the passage between Subula and Xylophagus unbroken.

The family STRATIOMIDÆ (*fig.* 127. 1. Stratiomys splendens) has the antennæ (*fig.* 127. 3. antenna of Stratiomys) composed of not

Fig. 127.



more than six or seven joints, terminated in many by a style, or seta, representing the remaining joints (*fig.* 127. 6. ant. of Oxycera, 7. ditto of Sargus). In some few (Stratiomys) the style is even obsolete; the terminal joints, five or six in number, in such instances forming a long fusiform mass. In others, Sargus and Pachygaster, the antennæ appear only 3-jointed; but the third joint, which is large and oval, or subglobose, when carefully examined, exhibits rudimental annuli, more or less distinct, indicating the situation of articulations closely soldered together, and is terminated by a seta (*fig.* 127. 7.). The scutellum is often spined; the wings are placed upon the abdomen, when at rest; the terminal veins very slender, and arising from a cell placed much nearer the centre of the disc of the wings than in the following tribes; the body is generally broad and depressed; the internal organs of the mouth are mostly rudimental (*fig.* 127. 2. mouth of Stratiomys, having only the labrum and maxillary palpi developed; the latter even are wanting in many).

These insects, in the perfect state, are generally found upon flowers in damp situations. They are mostly prettily coloured, some (Sargus) being of beautiful metallic tints; they are fond of sucking the sweets of flowers, as well as of basking in the sun on the broad and shining leaves of various plants.

There is considerable diversity in their habits in the preparatory states; the larvæ of some species (Stratiomys and Odontomyia) being aquatic, whilst those of Sargus are found under ground; and Pachygaster and Clitellaria Ephippium undergo their transformations in

rotten wood. They all, however, agree in retaining the larva skin nearly in its original form during their existence in the pupa state.

The larva (*fig.* 127. 4.) of Stratiomys chameleon (first figured by Swammerdam, *Book of Nature*, pl. 39, 40, 41.; Sparrman, in *Swed. Trans.* 1804; Schrank, in *Der Naturforscher*, st. 27.; Geoffroy, vol. ii. pl. 17.; Frisch, *Beschr.* vol. i. pt. 5. pl. 10.) is of an elongated form, without feet, depressed and attenuated at each extremity of the body, especially the posterior, in which the segments are greatly elongated; the head is small, corneous*, pointed in front; and the mouth is furnished with two hooks, four small points, and two palpi, dilated at the tips, and clothed with recurved hairs; these organs are kept in continual motion, so as to form a constant current, whereby small animalculæ (which are supposed to be the food of the insect) are brought to the mouth; the extremity of the body is furnished with a spiracle, surrounded by a great number of bearded hairs, which form a coronet, and which are capable of being closed up so as to retain a bubble of air, and by the assistance of which the insect suspends itself at the surface of the water for expiration. On assuming the pupa state, the insect floats at liberty in the water, the enclosed pupa (*fig.* 127. 5.) occupying only the anterior portion of its larva skin.†

Réaumur (*Mém.*, tom. iv. pl. 25.) has figured the transformations of Odontomyia ornata, which closely resemble those of Stratiomys, as does also those of Odontomyia hydroleon, figured by De Geer (*Mém.* tom. vi. pl. 9. f. 4.)

The larva of Vappo (Pachygaster) ater (*fig.* 127. 9.), described by Macquart (*Dipt. du Nord de France*), are elongated, depressed, 11-jointed, each joint having an elongated lateral seta; the head is conical, obtuse, and much narrower than the rest of the body; the parts of the mouth appear very rudimental, and are almost obliterated; the last segment of the body is large, black, and semicircular. These larvæ were discovered by M. Carcel in the rotten detritus of the elm (*Enc. Méth.* tom. x. p. 779.). M. Schilling has figured this larva

* Latreille (*Règn. Anim.* tom. v. p. 485.) describes it as "écailleuse," although in p. 478. he had described it as "molle, de forme variable;" thus erroneously establishing its similarity to the Athericera.

† It is probably on this account that Knoch (*Neue Beitrage*, 1801, p. 193.) and Meigen (*Zw. Ins.* vol. iii. p. 133.) entertained the opinion that authors had erred in their descriptions of the larva of Stratiomys, considering that the real larvæ of those insects were parasites within the bodies of the larvæ described as the true larvæ of Stratiomys!!

(*Entomol. Beitrage*, vol. i. tab. 8. fig. 8.), his figure agreeing with the above description.

The larva of Clitellaria Ephippium has been discovered by M. Van Roser of Stuttgart in a rotten nut tree; and this gentleman observed that, although more than half grown when found, it was two years in arriving at the perfect state. My *fig.* 127. 8. was made from the specimens contained in the collection of this gentleman during my visit to Germany last year.

The larvæ (*fig.* 127. 10.) of the genus Sargus are also of an oval oblong form, with the anterior segments narrowed; the head scaly, narrow, with two small ocelli at the sides, and armed with two hooks; the body has also a number of small hairs scattered over it; and the last segment is larger and semicircular, but narrower than the preceding segment.

The pupa is formed within the old skin of the larva, which does not essentially differ from its previous form. The perfect insect makes its escape by bursting off the anterior part of its covering.

Réaumur (*Mém.* tom. iv. tab. 13. f. 19, 20., tab. 14. f. 4. 6., and tab. 22. f. 5—8.) has given the transformations of one of the species, which has been named after him, and the larva of which was found in cow-dung. Lyonnet (*Mém. Posth.* tab. 17. fig. 21—24. 29.) and Bouché (*Naturgesch.* tab. 4. f. 31—36.) have figured the transformations of S. cuprarius, but neither of these authors have figured the true pupa. This I am fortunately able to supply, having found many of the larvæ of S. cuprarius in garden mould. It is represented in my *fig.* 127. 11.

Amongst the exotic species of this family, some exhibit several curious variations in structure. Platyna hastata (*Wied.* Guinea) has the abdomen short, but very broad, being nearly four times as broad as the thorax. Ptilocera has the male antennæ strongly bipectinated. Dicranophora furcifera ♂, figured by Guérin (*Icon. R. An. Ins.* pl. 98. f. 12.), has a very long, slender, upright horn arising from the scutellum, and forked at the tip.

The fossil insect figured by Curtis (in *Ed. N. Phil. Journ.* vol. vii. 1829, pl. 6. f. 12.), as apparently allied to Sargus, can have no relation therewith, the veins of the wings being totally unlike those of any Notacanthideous insect.

The family BERIDÆ (Decatoma p. *Latr.*, Xylophagi p. *Meig.*) has the

body moderately long (*fig.* 127. 12. Subula maculata); the antennæ are 10-jointed *, without any apical style or seta (*fig.* 127. 13. ant. of Subula), the eight terminal joints forming an elongated nearly cylindrical mass; the wings, when at rest, are laid upon the abdomen; the tarsi have three pulvilli, both in Beris and Subula; the scutellum is spined in some species (Beris); the terminal veins of the wings are of the ordinary thickness, and are disposed in a manner intermediate between those of the Stratiomidæ and Tabanidæ, to which last indeed Subula makes a close approach in this respect.

The species are mostly found in damp situations, and are of sluggish habits.

M. Van Roser (*Naturwiss. Abhandl.* or *Ann. Nat. Hist. Soc. Tubingen*, vol. ii. 1828; Meig. *Zw. Ins.* vol. vi. p. 319.; and Ferussac, *Bull. Sci. Nat.* June 1829) discovered the larva of Subula varia in an oak tree; it is of a brown colour, elongated, very much depressed, rather attenuated at each end; the body is composed of twelve segments, furnished on the upper side with hairs arising from small tubercles. The pupa is inactive, and is described as preserving the previous form of the insect. The real pupa, however, is enclosed within the skin of the larva, which does not change its form, thus agreeing with the other typical Notacantha. This is clearly shown in a specimen of the exuviæ, both of the larva and pupa of Subula varia, given to me by M. Van Roser, and represented in *fig.* 127.14., in which it will be seen that the delicate exuviæ of the real pupa are partially exserted out of the exuviæ of the larva; the pupa, according to M. Wesmael (who has subsequently published a description of the larva of Subula marginata, *Ann. Soc. Ent. France*, 1837, p. 91. app.), possessing the power of pushing itself forward, previous to assuming the perfect state, by means of small ciliæ directed backwards, and placed in rows at the extremity of each dorsal segment of the abdomen. The Rev. F. W. Hope has also given me specimens of Subula maculata and its preparatory state; the latter found by him in a dry rotten tree in the New Forest, and from which he reared the imago. It is larger than that of X. varia, but does not otherwise differ from it.

The transformations of Beris and Actina, the two other British genera of this family, have not been observed.

* Although Latreille names this family Decatoma, "ten joints," he describes the antennæ as 3-jointed, the last being divided into "huit anneaux."

I am inclined also to place, either in this family, or amongst the Cænomyidæ *, several extraordinary genera which have much perplexed entomologists in respect to their relations, such as Acanthomera and Raphiorhynchus (gigantic Brasilian species), and probably also Chiromyza *Wied.* and Agapophytus *Guér.*

There remains, however, another family of great interest in regard to the transition nature of the species of which it is composed; and although I here retain it amongst the Notacantha, in respect to the spined scutellum and articulation of the terminal portion of the antennæ, I cannot but consider that the differences in its transformations ought to induce its removal to the Tanystoma. This group, for which I propose the name of CÆNOMYIDÆ, comprises the genera Cænomyia and Pachystomus *Latr.* (forming Macquart's tribe Sicarii.†) The transformations of the former genus (which possesses 10-jointed antennæ, and has from its singular characters been placed amongst the Tabanidæ, Stratiomidæ, and Beridæ) are not known, but Latreille has described the pupa of Pachystomus syrphoides (*Genera*, &c. tom. iv. p. 287.‡) as closely resembling that of the Tabanidæ; being consequently an incomplete, and not a coarctate, pupa. This genus has 5-jointed antennæ. Meigen, not regarding this description, and unacquainted with the transformations of some other species closely related to this insect in the perfect state, retained the genus Xylophagus (previously proposed by him), the antennæ of which (*fig.* 127. 17.) are 10-jointed, and which he divided into two sections — A, having for its type *Xylophagus ater* § Meig. (vol. ii. pl. 12. f. 4., and my *fig.* 127. 16.), and B (or the genus Subula *Megerle*, above noticed), having for its type X. maculatus *Meig.* The genus Subula, as discovered by M. Van Roser and the Rev. F. W. Hope, has a metamorphosis exactly like Sargus, the pupa being enclosed within the unaltered larva skin, but the transformations of the typical Xylophagi are quite different;

* It is from ignorance of the transformations of these exotic groups that I express this indecision.

† If the generic name Sicus be not retained for the former of these two genera, this name ought surely also to be rejected.

‡ Zetterstedt also (*Ins. Lapp.* p. 513.) describes the pupa of this insect as "elongata, cylindrica, subnuda, incisuris ciliatis et apice breviter spinuloso, tota pallida, segmentis seu annulis 10 constare videtur."

§ Latreille confused this specific name in the plates and text of his 'Genera', and has retained his error in the *Règne Animal.*

M. Van Roser having described and communicated to me those of Xyl. ater *Meig.** The larva (*fig.* 127. 18.) of this insect † is an apod fleshy grub, of a somewhat cylindric form, having the tail defended by an oblique scaly plate, terminated by two short obtuse scaly horns (*fig.* 127. 19. sideways), whilst the anterior extremity of the body is terminated by a long acute horny joint. The structure of this larva is not that of a species having a coarctate pupa, and I am consequently thence led to infer the direct relation of Xylophagus with Pachystomus ‡, in a family distinct from that which contains Subula, although the only appreciable difference between Xylophagus and Subula consists in a slight variation in the direction of one of the veins of the wings. For the family thus constructed of Cænomyia, Pachystomus, and Xylophagus, I should have retained the name of Xylophagidæ, had not that name been used in a different extent by other authors, the retention of which would therefore have led to confusion. The mouth of Cænomyia (the only genus yet examined in respect to its oral characters, *fig.* 127. 15.) has the labrum, lingua, maxillæ, and palpi fully developed, and thus resembles the majority of the Tanystoma. The apex of the abdomen in the females is produced into a long, and often exserted ovipositor. Of the relations of these insects with the other Diptera, we thus see that in regard to their trophi and transformations, the Cænomyidæ in fact belong to the Tanystoma, whilst their close relation to Subula and other Notacantha has already been shown. Hence I cannot adopt the situation assigned to them by Macquart, Meigen, &c. immediately succeeding the Nemocera.

The insects composing the third stirps of the order Diptera, or the TANYSTOMA *Latr.*, are distinguished by having the antennæ composed

* M. Van Roser (*Verz. Wurt. Dipt.* p. 6.) notices the great difference between this larva (which he found in decayed birch-wood) and that of Subula varia, but without describing it. Baumhauer also found the larva of this insect in rotten wood, but did not describe it.

† The larva figured by Réaumur (*Mém.* tom. iv. pl. 13. f. 12–16.) evidently belongs to this or a closely-allied species.

‡ Meigen indeed gives them as congeneric, regarding P. syrphoides as identical with X. cinctus *De Geer*; whilst Fallen even makes this last a variety of Xylophagus ater. Macquart, however, states them to be generically distinct, and places them in distinct tribes; which is certainly unnatural, now that their transformations are known.

of only three joints, with a terminal seta.* The formation of their mouth, which is generally much exserted, is also much more perfect, exhibiting internally a lancet-like labrum and lingua, and a pair of maxillæ and maxillary palpi. In the Tabanidæ, moreover, the mouth is furnished in addition with a pair of lancet-like mandibles, at least in the females. In some of the Acroceridæ, however, which are nearly allied to the Bombyliidæ, the mouth is nearly obsolete.

The great character, however, by which the stirps is distinguished from the Notacantha and Athericera, consists in the nature of the metamorphosis to which all the species are subject.

The larvæ resemble worms, being nearly cylindric, without feet, and with a scaly head of a constant form, always furnished with unguiform retractile appendages, enabling them to pierce the substances whence they derive their support: for the most part, they reside under ground, and are but little known. They shed their skin previous to assuming the pupa state, in which, to a certain extent, they resemble the imago, having the various limbs enclosed in distinct sheaths, and folded upon the breast. The perfect insect escapes from this state by means of a slit down the back.

Many of the perfect insects are eminently carnivorous or insectivorous.

The following distribution of the families composing this stirps appears to me to combine their affinities in a more natural manner than in the methods proposed in Latreille's later works. It will be seen that it differs only in few respects from a portion of the sketch given by Latreille in the *Genera Crust.* &c. vol. iv. p. 243. n. 1.

Section 1. Proboscis with six internal setæ. (Fam. Tabanidæ.†)
Section 2. Proboscis with four internal setæ.
- Subsection A. Proboscis siphon-shaped; body short, broad; wings divaricating. (Fam. Bombyliidæ, Anthracidæ, and Acroceridæ.)
- Subsection B. Proboscis siphon-shaped; body long; wings incumbent. (Fam. Empidæ, Tachydromiidæ, Hybotidæ, and Asilidæ.)
- Subsection C. Proboscis dilated, with two large exserted lips; wings divaricating or incumbent. (Fam. Mydasidæ, Therevidæ, Leptidæ, Dolichopidæ, and Scenopinidæ.)

By this arrangement of the families, Tabanus is introduced amongst the other groups having an incomplete pupa, instead of being united

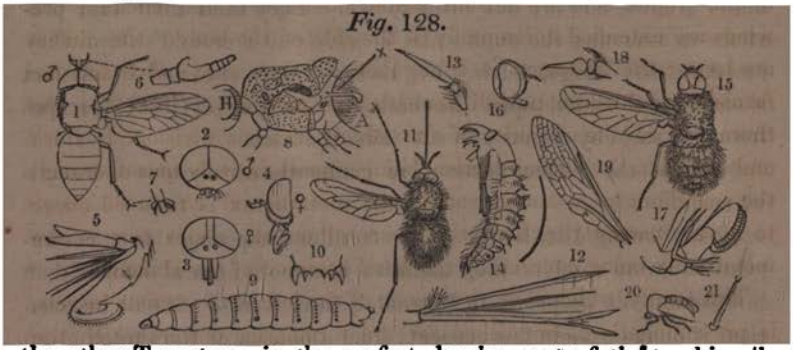
* The Tabanidæ, however, as well as the Mydasidæ, have no terminal seta, and the third joint of their antennæ is articulated.

† Latreille excepts Pangonia: it, however, certainly has six internal lancets in the females, although the males, as in Tabanus, &c., have only four.

with the Notacantha into a separate division called Entomocera, as proposed by Macquart (*Dipt. Exot.* tom. i. p. 89.). The long rostrated genus Pangonia forms the connection between the Tabanidæ and Bombyliidæ, whilst the Acroceridæ appear to connect such Anthracidæ as Nemestrina and the Empidæ; but this connection is very slight and unsatisfactory. The Mydasidæ intervene between the Asilidæ and Therevidæ, to both of which, in general appearance, habits, and trophi, they are nearly allied, and the Platypezidæ and Dolichopidæ are brought into contact with the Athericera, with which the nerves of their wings agree.

The family TABANIDÆ*, corresponding with the Linnæan genus Tabanus (*fig.* 128. 1. Tabanus paganus ♂), is distinguished from all

Fig. 128.



the other Tanystoma in the perfect development of the trophi; all the parts of the mandibulated mouth, except the labial palpi, having here their representatives, as clearly established by Savigny, in his admirable memoirs. The proboscis is exserted, and in the female

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* BIBLIOGR. REFER. TO THE TABANIDÆ.

De Geer. Bromsarnas Ursprung (De Origine Tabanorum), in Vetensk. Acad. Handl. 1760; and in his Mémoires, tom. vi.

Gaede, in Wiedemann's Zool. Magaz. (Anat. Taban. bovinus.)

Thunberg. Tabani, 17 n. sp. descr. in Nov. Act. Upsal. vol. ix. — Ditto, Tanyglossæ, 17 n. sp. descr. in ditto, vol. ix. 1827.

Duncan, in Magazine of Zool. and Bot. vol. i. (Brit. Species.)

Hardwicke. N. sp. Pangonia, Trans. Linn. Soc. tom. xiv.

Fallen, in Swed. Trans. 1809.

Macquart, on Pangonia, in Ann. Soc. Ent. d. France, 1837.

And the general works on the order; also *Palisot Beauvois.*

encloses six (*fig.* 128. 5.), but in the male only four lancet-like instruments. It is terminated by two fleshy lip-like lobes, and is defended at the sides by the maxillary palpi, which are large, and 2-jointed. The third joint of the antennæ is large, and often with an excision before the middle, and extending to the extremity of the joint; the remaining joints, varying in number from three to seven, are closely united and attenuated to the tips (*fig.* 128. 6.). The eyes are very large, and nearly cover the whole head, especially in the males, in which, also, the upper facets are of a larger size than the lower ones. (Macquart, *Hist. N. Dipt.* tom. i. p. 189. A similar remark has been made by Mr. Ashton, in a paper read before the Entomol. Society. In the males of Tabanus, which I have examined, it is only the middle facets which are enlarged.) The eyes are, moreover, often very beautifully coloured (*fig.* 128. 2. face of male showing the small size of the trophi, 3. head in front, and 4. sideways, of the female); the wings are extended horizontally at the side of the body; the alulets are large; the abdomen is triangular and depressed; the tarsi are furnished with three pulvilli beneath the ungues (*fig.* 128. 7.); the thorax, as in the majority of the Brachoceratous division, is thick and compact, the dorsal portion being almost entirely mesothoracic; the scutellum large and elevated; the metathorax is reduced above to a very narrow ring beneath the scutellum, the major part of the metathorax being covered by the basal segment of the abdomen.*

This family, which comprises some of the largest Dipterous insects, is pre-eminently distinguished for the tormenting powers which the different species possess of piercing the skins and sucking the blood of various quadrupeds, and even of man himself. They abound in woods and pastures, and make a buzzing noise, whence they have obtained the English name of "the breeze." (See Mouffet, p. 51., and *The New World of Engl. Words*, 1658.) They are also called gadflies, and some of the smaller species are called clegs. The insect of which Bruce has spoken in his *Travels in Africa*, under the name of Tsaltsalya or Zimb (and which attacks cattle in so dreadful a manner, that unless immediately driven to the sands of Atbara, they forsake their food, and run wildly about the plains, dreading even "its very sound," until they die, worn out with fatigue, fright, and hunger), has been by some writers considered to be a species of this family.

* *Fig.* 128. 8. represents the thorax of Tabanus seen laterally; the mesothorax being dotted. The terminal striped part represents the base of the abdomen A, concealing the majority of the metathorax x.

The camel, and also the elephant and rhinoceros, as Bruce supposes, are subject to this enemy. "When the first of these animals is attacked, its body, head, and legs break out into large bosses, which swell, break, and putrify, to its certain destruction. The British Association, at the meeting held at Cambridge, selected this insect as a fit subject to be proposed for further research. According to Desfontaines, the Tabanus Maroccanus *Fab.* torments the camels in the North of Africa, the bodies of which are sometimes literally covered with these insects, so that there is reason to believe that the zimb is the latter insect, or one nearly allied, belonging to the same genus, although there seem nearly equally strong reasons for believing it to belong to the family Œstridæ. (See Marquis Spineto on the Zimb, in Taylor's *Phil. Mag.* March 1834.)

Olivier, Latreille, and MacLeay, are of opinion that the οἶστρος of the Greeks, and Asilus of the Romans, was a species of Tabanidæ, the latter author especially, from the description given of the insect by the ancients, endeavouring to prove at great length that it was a species of Chrysops. Mr. Bracy Clark, on the other hand, has with equal skill maintained the opinion that as no other insect than Œstrus Bovis is capable of producing such effects as are so admirably described by Virgil, the οἶστρος must have been that insect.*

It appears, however, to me, that in this controversy too little poetic licence has been allowed to the old poets. Who is not aware of the difficulty of determining the species of insects popularly noticed even by the old poets of our own country? I can easily believe that these writers, perceiving, as they could not fail to do, that the blood-sucking Tabani are unceasing in their attacks upon horned cattle, would, without question, at once couple them with the effects produced by the Œstri upon the same animals.† Hence, unlike the umpire in "The Chameleon" who addressed the disputants—

> ——— "Sirs, cease your pother,
> "The creature 's neither one nor t'other;

* MacLeay, in *Trans. Linn. Soc.* vol. xiv.; Ditto, in *Zool. Journ.* No. 17.; Bracy Clark, in *Trans. Linn. Soc.* vol. xv., *Zool. Journ.* No. 12.; Keferstein, in *Bull. Sci. Nat.* April 1829; and Latreille, *Cours d'Entomol.* p. 116.

† Just in the same manner as Linnæus was led to believe that Asilus crabroniformis was the insect which caused all the irritation amongst the cattle in the north of Europe. (*Tour in Lapland*, i. p. 215.) This opinion has been overlooked by MacLeay and Clark.

I think with the Chameleon itself that

" You both are right, and both are wrong."

It has long been noticed that (as in the Culicidæ) it is only the females of these insects which are blood-suckers, the males being found on flowers; and Meigen discovered that the mouth of the latter sex is destitute of mandibles. The same remark has also been made by Curtis in Hæmatopota*, whence he is induced to believe that it is the mandibles which are the real piercing instruments, and that the other enclosed lancet-like pieces form a canal for the upward passage of the blood. M. Westermann observed of Pangonia rostrata (Silberm. *Rev. Ent.* No. 3.), that its bite is very powerful, but it is only able to inflict a wound upon cattle whilst on the wing, owing to the very great length of its proboscis†; it seems, however, to prefer the flowers of Pelargonium, upon which it is often found. M. Serville, however (*Ann. Soc. Ent. France*, tom. ii. p. 493.), suggests that it is only the males which are found in the latter situation from analogy with the Tabani.

We are indebted to De Geer for the knowledge we possess of the transformations of this family. The larva (*fig.* 128. 9.) of Tabanus bovinus *De Geer* (*Mém.* tom. vi. pl. 12. f. 6.) is found in the earth, and is of an elongated subcylindric form, attenuated at each end, especially in front; it is destitute of feet, 12-jointed, having the head distinct, narrow, elongated, horny, armed with two strong curved hooks, antennæ and palpi; the fourth to the tenth segments having an elevated dorsal papillose ridge used in progression; the terminal segment is minute and tuberculiform; the pupa is naked, incomplete, elongated, subcylindrical, with six spines at the end of the body (*fig.* 128. 10.); the margins of the abdominal segments ciliated, and the forehead bi-tubercled.

* He is silent as to the composition of the mouth of the male of Tabanus.

† In the species of Pangonia observed by Meigen (vol. ii. tab. 13. fig. 3, 4.), the proboscis is not more than half the length of the body, and the enclosed lancets are as long as the labium; but in P. longirostris *Hardw.*, which I have dissected, and in which the rostrum is nearly three times the length of the body, the six enclosed lancets are not half the length of the labium. I consequently do not think that the insect can use these lancets, except by detaching them from the labium, and holding the latter at a great angle from the other parts of the mouth.

The family BOMBYLIIDÆ*, corresponding with the genus Bombylius *Linn.* (*fig.* 128. 11. Bombylius major), has the body short and thick; the wings extended horizontally on each side of the body; the alulæ small; the proboscis long, and porrected in front of the head; the labrum is spear-shaped, the lingua as long, but more slender, the maxillæ exceedingly delicate (*fig.* 128. 12. mouth of Bombylius after Curtis); the palpi are composed of a single joint; the antennæ are closely approximated at the base, often with a short terminal style (*fig.* 128. 13. ant. of Bombylius); and the thorax is much elevated, so that the head appears to be inserted very low; the antennæ have the third joint oval or fusiform and flattened, terminated by a short style, but without any seta, and the legs very long and slender; the wings are generally apart when at rest, and they have mostly four posterior cells; the body is often thickly clothed with hairs; the ocelli are three in number. These insects fly with astonishing rapidity, hovering at times over flowers without settling, and extracting the nectar by means of their long proboscis, making at the same time a considerable humming with their wings. (White, *Selborne*, vol. ii. p. 233.; Bree, in *Mag. Nat. Hist.* No. 31.) Latreille supposes that their larvæ, as well as those of the Anthracidæ, are parasites†, whilst Macquart conjectures they live in the ground (*Hist. Nat. Dipt.* tom. i. p. 376.), and Zetterstedt states that they feed on the roots of plants (*Ins. Lapp.* p. 510.).

I am indebted to Mr. Pickering for an opportunity of delineating the pupa (*fig.* 128. 14.) of Bombylius major, which that gentleman discovered in sandy gravel pits at Coombe Wood, on the 28th of March, and from which the imago was produced in a few days. This pupa has the back much arched, the front and under side of the head armed with strong spines; the abdominal segments furnished at the sides with numerous long curved setæ, as well as dorsally with transverse

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* BIBLIOGR. REFER. TO THE BOMBYLIIDÆ.

Mikan. Monogr. Bombyliorum Bohemiæ, 8vo. Prag. 1796.
Modeer, in Physiol. Salsk. Handl. vol. i. (Descr. g. Bombylius.)
Duncan, in Mag. Zool. and Botany, vol. ii. (Brit. species.)

† MacLeay (*Annals of Nat. Hist.* Sept. 1838) states that the larvæ of those tropical Bombylii which have such a bee-like form live on the larvæ of the bees they so strikingly represent.

series of strong reflexed hooklets; the leg cases extend considerably beyond the wing-cases, and the case which encloses the long proboscis lies between the legs; the extremity of the body is also spined. M. Imhoff has also figured the pupa of this insect in the *Isis* for 1834.

The species of this family are for the most part exotic; many of them differ from the typical species in the much longer form of the body, and of the antennæ and the shorter rostrum; amongst these the more remarkable are Systropus *Wied.*, which in its form resembles the Hymenopterous genus Ammophila and Lepidophora *Westw.* (in *Phil. Mag.* June, 1835), which has the remarkable aspect of Ægeria, with long scaly antennæ and a tasselled tail. I have figured the typical species L. Ægeriiformis in Griff. *An. Kingd. Ins.* pl. 128. I possess this as well as another species, both being from Georgia in North America.

The family ANTHRACIDÆ (*fig.* 128. 15. Anthrax Hottentotta), forming part of the Linnæan genus Musca, differs from the preceding family to which it is nearly related, in having the thorax but slightly elevated; the head is nearly spherical (*fig.* 128. 16.); the antennæ are very short, and inserted at a distance from each other, and terminated by an elongate pear-shaped joint, being very attenuated at the tip (*fig.* 128. 18.); the proboscis is generally very short, and often withdrawn into the oral cavity; in a few instances, especially in the exotic genus Nemestrina, it is, however, very long; the palpi are slender, filiform, and composed of a single joint (*fig.* 128. 17. mouth of Anthrax after Curtis); the abdomen is squarer than in the Bombyliidæ, and the legs are long and slender, the tarsal pulvilli very small or obsolete. They are generally of moderate or large size, often covered with hair and beautifully coloured, the wings also being much maculated; they are for the most part exotic, very few species being found in this country; they fly in the sunshine with great agility, and the species which I have observed on the Continent appear to delight in alighting often on the ground and upon walls exposed to the sun. They subsist in the perfect state upon the juices of flowers.

Macquart states that the larvæ are not known, and Latreille says, "Larva parasitica? Pupa nuda, incompleta, spinosulo-annulata." (*Genera, &c.* tom. iv. p. 307.) Réaumur (*Mém.* tom. vi. pl. 27. f. 13.)

figures Anthrax morio, of which he observes, "Plusieurs mouches de cette espèce ont été tirées d'un nid creusé dans le bois" (p. 290.); he, however, considered that these specimens had been stored up by some of the fossorial Hymenoptera for the food of their progeny (p. 272.). Zetterstedt observes, "Plerasque species ova in terra arenosa (corpore scilicet perpendiculariter erecto vaginaque anali elongata in arena emissa) deponere sæpe observavi. Igitur, 'Larvas in terra uliginosa metamorphosin subire' immerito statuit Fallen, nec 'imagines juxta aquas stagnantes' versari vidi. 'Larvas in ligno putrido vivere,' dicit Meigen, quod tamen vix credibile mihi videtur." (*Ins. Lapp.* p. 521.) This author also discovered seven or eight pupæ of Anthrax sinuata (which he describes exactly corresponding with my specimens subsequently mentioned) under a stone, "intra folia Betulæ nanæ in formam cylindrorum conglomerata, occultis."

All these authors have, however, overlooked the direct observations of Schäffer, who has figured the larva (*fig.* 129. 1.), pupa, and imago of Anthrax ornata (or a closely allied species) as one of the parasites in the nest of the mason bee (Megachile muraria) (*Abhandl. v. Ins.* vol. ii. pl. 5. fig. 11, 12, 13.).

M. V. Audouin has confirmed in his unpublished observations the parasitic habits of Anthrax morio by rearing it from the nest of an Anthophora. He has given me one of the exuviæ of the pupa, which retains its previous pupa-form, and exactly resembles the pupa of Bombylius. He remarked that the Anthrax makes its way out of the cell of the bee, immediately before assuming the perfect state, by the assistance of its dorsal spines, in the same manner as Cossus. I have also found exactly similar exuviæ in the nest of Megachile muraria.

M. Percheron, on the other hand, figures the pupa of Anthrax sinuata, together with a cell of earth formed by the larva (*Genera Insect. Dipt.* pl. 1.).

M. Macquart has separated the genus Nemestrina * from the Anthracidæ from its shorter form, the great elongation of its proboscis extending beneath the body, and several other characters; it appears to me, however, to constitute a link between the Bombyliidæ and the Anthracidæ, the veins of the wings of the latter being very variable,

* See Olivier sur le g. Nemestrina (*Nouv. Bull. Soc. Phil.* 1810); Fischer (in *Act. Mosq. Nat.*) (Rhynococephalus, *Nemestrina*); Westwood (in *Lond. and Edinb. Phil. Magazine*, June. 1835).

leading to those of Nemestrina, which in some species are very much reticulated (*fig.* 128. 19. wing of N. longirostris). The species of this interesting group are exotic, especially frequenting hot localities. M. Westermann has observed that N. longirostris (in which the proboscis is at least three times as long as the entire body, and exceedingly slender, and which is an inhabitant of the Cape of Good Hope), solely resorts to the species of Gladiolus, of which it sucks the honey with its long snout, which just equals the length of the tube of the flower; when unemployed, the proboscis is directed back beneath the body (Silberm. *Rev. Ent.* No. 3.).

The family ACROCERIDÆ* (*fig.* 128. 20. Ogcodes gibbosus), also forming part of the Linnæan genus Musca, is of small extent, and composed of insects generally of small size, having the body short and thick, the abdomen being round, and very much swollen; whence these insects have been termed Vesiculosa. The thorax is very elevated, with the wings deflexed; the winglets are very large, covering the balancers. The antennæ (*fig.* 128. 21.) are very minute, and inserted close together; and the proboscis either long and bent beneath the body, or obsolete. The eyes are very large, and occupy the major part of the head, which is, however, so minute, and attached so low, as to be almost invisible from above. The veins of the wings are variously and singularly arranged, and sometimes very indistinct. The species exhibit a general degree of weakness in their construction. Their movements are slow; and they are found upon plants, and amongst flowers. The species are but few in number, and chiefly exotic. Their larvæ have not been observed. In a preceding page (p. 189.) I have noticed the curious fact, observed both by the Senator Van Heyden and M. V. Audouin, of the very rare Ogcodes gibbosus being selected by a species of Crabro, which burrows in wood, as the food of its progeny.

The true situation of this family, in a natural system, is very difficult to be determined.

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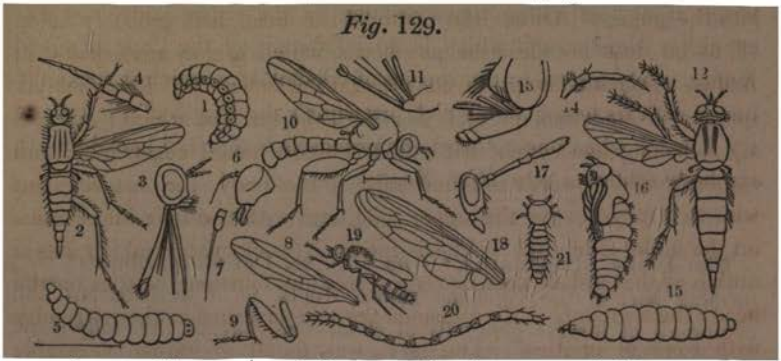
* BIBLIOGR. REFER. TO THE ACROCERIDÆ.

Lamarck, in Ann. du Mus. d'Hist. Nat. tom. iii. (Panops).

And the general works of *Meigen*, *Wiedemann*, *Macquart*, *Griffith* (An. Kingd.), and *Perty* (Del An. art. Braz.).

The family Empidæ*, nearly corresponding with the Linnæan genus Empis (*fig.* 129. 2. Empis tessellata), closely resembles the Asilidæ, in the elongated form of the body, incumbent wings, and voracious habits. The head is small, rounded, and nearly globose; with the

Fig. 129.



eyes large. The proboscis is generally elongate, and either perpendicular, or folded beneath the breast; with the palpi reflected, and generally 2-jointed (*fig.* 129. 3. head and mouth of E. tessellata). The antennæ are as long as the head, and attenuated to the tips; the second joint the smallest, and the third joint longest, terminated by a biarticulate style (*fig.* 129. 4. ant. of E. tessell.). The wings are large, with an elongate discoidal cell a little below the middle of the wing, which is, however, sometimes wanting. The abdomen is narrower than the thorax; the legs are of moderate length. These insects are of small size, but of robust and active habits, living by prey, or upon the nectar of flowers; the latter being especially the food of the males. They are ordinarily very voracious, seizing upon other insects of considerable size, from which they suck the juices. Many species assemble in considerable numbers: these swarms are often to be observed over standing water, where they alternately fly forwards and backwards, as though endued with but a single impulse, or driven about by the wind. The females, especially, are quite ravenous; and it is seldom that a pair is taken coupled, without this sex being found to be occupied in sucking another insect nearly as large as herself.

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* Biblioge. Refer. to the Empidæ.

Fallen. Empides Sueciæ, 4to. 1816.
Macquart. Monogr. Ins. Dipt. Empides de la France, Lille, 1823.

But little is known of the preparatory states of these insects. M. Macquart, indeed, states that he once found a specimen of Empis opaca in the act of disengaging itself from the pupa skin, which he describes (*Hist. Nat. Dipt.* tom. i. p. 326.), and which closely resembles the pupa of Asilus: the front of the head had probably fallen off, as he does not describe any horns, which are so remarkable in Asilus. Bouché has observed the transformations of Ramphomyia spinipes (*Naturgesch.* pl. 4. f. 26—30.), the larva of which (*fig.* 129. 5.) is a long apod grub, with the segments much constricted, and rather broader towards the hind part of the body, the last segment with two spiracles on the upper side, and with two long impressions on the under side. The pupa is incomplete, elongate-oval; it has a mucro at the end of each antenna-case, and four long bristles on the head: the segments of the abdomen are also furnished at the extremity with rows of bristles. The larva was found in garden vegetable mould.

The TACHYDROMIIDÆ is a family of minute, very active insects, nearly allied to the Empidæ (with which they are united by Latreille and Stephens), remarkable for the peculiar construction of the legs, and which have the antennæ apparently only 2-jointed, with a long terminal seta (*fig.* 129. 7.): another basal joint, however, exists, but it is very small. The proboscis is generally short, and the palpi are incumbent (*fig.* 129. 6. head of Tachydromia). The wings have not the large cell beyond the middle (*fig.* 129. 8. wing of Tach. arrogans); they are often ornamented with coloured fasciæ. The fore legs in the genus Hemerodromia are raptorial, having the coxæ very much elongated, and the femora thickened and spined (*fig.* 129. 9.): the latter character, in the first or second pair of legs, also occurs in the genus Tachydromia. The latter generic name is very characteristic of the habits of the typical species, which run with wonderful quickness, with their wings lying flat on the back, especially on the trunks of trees; others are found amongst herbage.

There has been so much confusion in the employment of the generic name Sicus (first proposed by Scopoli for the insects which Fabricius afterwards called Myopa; subsequently, in 1796, used by Latreille for the typical genus of the present family, afterwards called Tachydromia by Meigen; then, in 1798, given by Fabricius to the genus afterwards named Cænomyia by Latreille; and, lastly,

used by Macquart for the name of the family typified by the last-named genus for which, however, he employs the name Cænomyia, and not Sicus), that it would be advisable that it should be entirely rejected, unless, indeed, it be restored to the genus Myopa.

Like the last family, the HYBOTIDÆ are of a small size, and of dark uniform colours (*fig.* 129. 10. Hybos flavipes). The head is small and spherical, with the eyes, in the males, occupying nearly its entire surface. The clypeus is but slightly hirsute. The proboscis is short, and directed horizontally. The mandibles and maxillæ appear to be wanting (*fig.* 129. 11. mouth of Hybos). The veins of the wings resemble those of the Empidæ, having a discoidal postmedial cell; but they are much fewer in number than in the Asilidæ, not having the internal triangular cell observed in that family. The femora of the hind legs are often thickened. The thorax is very elevated, and the abdomen narrow.

The species are active, and, for the most part, prey on other insects; some, however, are found upon flowers. Their transformations have not been observed.

The genus Cyrtoma, placed by Mr. Haliday in this family, seems to me to belong to the Sicidæ. The nervures are totally different from those of any Hybotidæ.

The family ASILIDÆ, answering to the genus Asilus of Linnæus, is composed of numerous species, of large size (*fig.* 129. 12. As. crabroniformis), and of which the body is long, and clothed with stiff bristles, with the thorax narrowed in front. The wings are incumbent, with a perfect triangular cell terminating near the interior margin of the wing: above this is a perfect elongate postmedial cell. The head is transverse, and very depressed; the eyes lateral; the lower part of the face bearded; and the proboscis porrected in front, about as long as the head (*fig.* 129. 13. head and mouth of Asilus): the labial lobes are scarcely distinct. The antennæ have the third joint either subclavate or elongate-attenuated, and terminated by a short 2-jointed style or seta (*fig.* 129. 14.). These insects (some of which are amongst the largest Dipterous insects) make a humming noise when on the wing. They are very powerful and active in the sunshine, preying

voraciously upon such other insects* as they can overcome, and of which they suck the fluids. Macquart states, that the large species attack cattle in the same manner as the Tabani.† The species are far more numerous in the hotter regions of the globe than in temperate climes.

The larvæ, which reside under ground, and feed on the roots of plants, are apod, elongated, depressed, 12-jointed grubs (*fig.* 129. 15.), having a scaly head, armed with two moveable unguiform appendages; and the prothoracic and anal segments are respectively furnished with a pair of spiracles, the posterior pair being tubular. They are transformed into pupæ (*fig.* 129. 16.), which are naked and incomplete, posteriorly attenuated; the forehead being armed with two strong curved spines, and the sides of the head with three, placed closely together. On each side of the thorax, near the head, is a tubercle, which Latreille presumes may be a spiracle. The abdominal segments are armed with rows of spines, and the apex is 4-spined. Frisch (*Beschr.* i. pt. 3. tab. 7. and 8.) has illustrated the transformations of Asilus forcipatus and crabroniformis; the former of which has been also described and figured by De Geer. (*Mém.* tom. vi. pl. 14. f. 5—9.) Harris also (*Exposit. Engl. Ins.* t. 17.) figures the transformations of this genus.

The family MYDASIDÆ‡ is of very small extent and anomalous character, some of the species being the most gigantic of the whole order, and for the most part exotic. The antennæ are generally much

* Robineau Desvoidy (*Comptes Rendus* 1836, No. 23.) states that he had observed Asilus Diadema flying with a bee in its hold several times, and had seen it settle in a situation where there was a burrow; he did not, however, see the Asilus actually bury the Apis. Indeed, it appears to me unquestionable, that it was for its own food that the Asilus had captured the bee, and not for a supply of food to be laid up for its progeny, as in the case of the fossorial Hymenoptera.

† Linnæus, indeed (*Tour in Lapland*, vol. i. p. 217.), describes Asilus crabroniformis as the cause of the terror evinced by cattle, now attributed to Œstri; and he accounts for the animals seeking retreat in water, from the circumstance that the Asilus flies close to the ground, and attacks the lower part of the legs of the animals. The latter statement, given in the first edition of the *Fauna Suecica*, on the authority of the common people, is omitted in the second edition of that work.

‡ See Wiedemann's monograph on the genus Mydas, in *Nova Acta Natur. Curios.* vol. xv. pt. 2.; also Westwood, in Taylor's *Phil. Mag.* April, 1835 (additional species).

longer than the head, with five distinct joints; the two terminal ones (which are distinct, although much smaller, in the Asilidæ and Empidæ) being large, and forming a club (*fig.* 129. 17. head and antenna of Mydas). The apical nerves run parallel with the posterior margin of the wing (*fig.* 129. 18.), as in Pangonia. The body is long, the legs strong, and the tarsi furnished with two pulvilli; the hind femora are thickened.

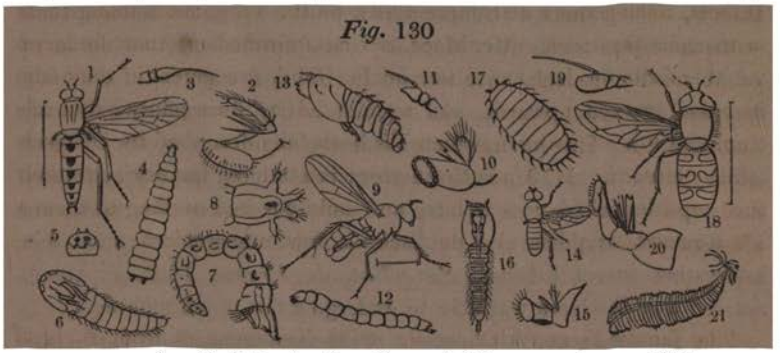
These insects, according to Macquart, attack and devour other insects, seizing them with force whilst on the wing, and holding them with their fore legs. Mr. MacLeay has informed me that the larvæ of M. tricolor (which he observed in Cuba) are parasitic upon the larvæ of the giant Prioni. In some of Latreille's works we find this family united with the following; but the neuration of the wings is quite different. M. Macquart has entered into an inquiry as to their real affinities, and seems to have no hesitation in assigning to them a close relation with the Asilidæ. Such is also my opinion.

The family THEREVIDÆ, or the tribe Xylotomæ of Meigen, is of very small extent (*fig.* 129. 19. Thereva plebeia), having the wings divaricate, and offering several perfect cells, formed nearly as in the Leptidæ; the apical nerves running to the extremity of the wing. The palpi are enclosed in the oral cavity. The proboscis is terminated in a pair of large membranous labial lobes, thus differing from the preceding Tanystoma. The third joint of the antennæ is ovate conic, and terminated by a minute triarticulate style. The abdomen is conical. Many of the species are clothed with a silky kind of down. They are of moderate size, and are generally found upon trees; sometimes they are seen flying in swarms. The larva of Thereva plebeia, first observed by Frisch (*Beschr.* pt. 1. tab. 9.), and recently by Bouché (*Naturgesch.* tab. 4. fig. 16—20.), is very long, slender, and serpentiform (*fig.* 129. 20.). The head is small, with two short antennæ. The body appears to consist of twenty distinct segments (at least the intermediate segments seem divided into two parts): the body is furnished at the extremity with two respiratory tubes. These larvæ were found in vegetable garden mould. The pupæ (*fig.* 129. 21.) are oblong, having the front of the head armed with two spines, and each side of the thorax with three, the middle one being the longest and curved. Meigen has also observed the

transformation of Thereva nobilitata (*Syst. Beschr.* vol. ii. p. 117.), the larva of which he found in rotten wood. L'Admiral has also figured the larva, pupa, and imago of an insect which appears to me to be a large species of Thereva. (*Naauw. Waarn.* tab. 19.)

The LEPTIDÆ (Leptides *Latr.*, Rhagionides *Latr.* olim) (*fig.* 130. 1. Leptis scolopacea) are distinguished from the Therevidæ, to which they

Fig. 130



are very nearly allied, by having the palpi large, externa, filiform or conical; the proboscis large, fleshy, and terminated by two elongated labial lobes (*fig.* 130. 2. mouth of Leptis); the antennæ are inserted near the base of the head, with the third joint either short and rounded or kidney-shaped, and terminated by a long seta (*fig.* 130. 3. antenna of Leptis); the tarsi are terminated by three pulvilli; the wings are divaricate, and exhibit several perfect cells; the external nerve is furcate; the middle and posterior tibiæ have two apical spurs.

The species are of a moderate size, and generally varied in their colours, their wings being occasionally spotted. The species of the typical genus frequent the trunks of trees, especially preferring the sides exposed to the sun. On alighting, their first movement is to place themselves in a position with the head downwards. Other species frequent low plants, grass, &c.

De Geer has observed that the females deposit their eggs either in the earth or in vegetable mould. The larvæ (*fig.* 130. 4.) are elongate, apod, subcylindrical grubs, with the posterior segments gradually widening, and terminated behind in two points, beneath which is an oblique truncation with two spiracles (*fig.* 130. 5.); the head is small, scaly, and bears a pair of antennæ in the typical genus (Bouché,

Naturg. tab. 4. fig. 11—15. larva and pupa of Leptis scolopacea); the pupa (*fig.* 130. 6.) is naked, incomplete, cylindrical, with transverse rows of spines on the abdominal segments, and with larger spines at the extremity of the body; the larva (*fig.* 130. 7.) of one of the species of this family (Vermileo De Geerii *Macquart*, Leptis Vermileo *Fab.*), has the singular habit of forming small conical holes in the sand, like the ant lion, for the purpose of entrapping small insects, round which it entwines itself, and then destroys and sucks them. It twists itself about with the greatest activity. The larva of this species is elongate, cylindric, attenuated in front, with a small soft head of variable form, furnished with two hooks; the last segment of the body is broad, curved upwards, and terminated by four pilose tentacles (*fig.* 130. 8.). This larva, which has been fully described by De Geer (*Mém.* tom. vi. pl. 10.), is three years in attaining the perfect state; the pupa is naked, incomplete, and only covered by the sand; M. De Romand, who has also published a few observations upon this interesting insect (*Annal. Soc. Ent. de France*, 1833, p. 498.), noticed that the larva was able to undergo a fast of six months.

The European genus Clinocera of Meigen appears, from the arrangement of the wing-nerves, to form the passage to the next family.

The family DOLICHOPIDÆ* comprises a considerable number of small brilliant metallic-coloured flies (*fig.* 130. 9. Dolichopus cyaneus), having the wings when at rest incumbent upon the abdomen, seldom with more than one perfect cell, the disposition of the nerves nearly resembling that of the Muscidæ; the antennæ (*fig.* 130. 11. ant. of Dolichopus) are short, terminating in a small palette-shaped or oval joint, emitting a long seta; the palpi are very broad and flattened; the labrum horny and dentate, serving as a defence to the labium which is very large and fleshy, especially in the females, in which

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* BIBLIOGR. REFER. TO THE DOLICHOPIDÆ.

Cuvier, in Journ. d'Hist. Nat. vol. ii.

Fischer. Notice sur une Mouche carnivore (Medeterus), 4to. Mosc. 1819.

Stannius, in the Isis, 1831.

Haliday, in Zool. Journ. No. 19.; and in Entomol. Mag. *passim.*

it forms a conical muzzle; the tongue is short and acute, but the maxillæ and mandibles are wanting (*fig.* 130. 10. mouth of Dolichopus)*; the abdomen is compressed and incurved at the tip, with the male organs of generation often exserted in the shape of flattened setæ or plates; the legs are long and slender, armed with strong bristles. In several important characteristics, these insects approximate to the Athericera, and recede considerably from the type of the Tanystoma.

Some of these insects are found running with great agility forwards, sideways, and backwards, upon walls, trunks of trees, &c., in damp situations; others delight in frequenting the wet edges of water, flying over its surface, and resting upon any thing which may happen to be floating upon it. It is seldom that they are found upon flowers. The Medeteri and Hydrophori subsist upon other insects; and M. Macquart states that he once captured a species of the latter genus engaged in sucking the larva of a Tettigonia; Mr. Doubleday also observed Medeterus loripes engaged in capturing Poduræ on the surface of water (*Ent. Mag.* vol. iii. p. 414.).

The larva of Dolichopus ungulatus (the only species of which the transformations have been observed), according to De Geer (*Mém.* tom. vi. pl. 11. fig. 19.), resides in the earth; it is apod, cylindrical, 12-jointed (*fig.* 130. 12.), with a head of variable shape, furnished with two hooks; the last segment is incrassated, and reflexed and bicuspidate at the tip, with two tubercles above, each bearing a spiracle; the pupa (fig. 18. and my *fig.* 130. 13.) is naked, incomplete, elongate-ovate; the thorax with two curved horns; and the segments of the abdomen are dorsally furnished with rows of bristles.

The British genus Diaphorus, having the eyes in the males nearly extending over the entire surface of the head, appears to connect this family with the Scenopinidæ.

The family SCENOPINIDÆ (*fig.* 130. 14. Scenopinus fenestralis), in which, after Latreille, I have united Meigen's families Platypezinæ, Megacephali, and Scenopinii, or the tribes Scenopiniens, Cephalopsides, and Platypezines of Macquart, is of small extent, and composed of insects of small size, obscure colours, and difficult location. In the

* Mr. Haliday describes them as present in Machærium and Porphyrops.

formation of the antennæ and wings, they very nearly approach the Dolichopidæ, with which some of them were united by Latreille in the *Genera Crustaceorum*. The body is, however, flattened; the head hemispherical, and almost entirely occupied by the eyes in the males; the legs are short, the posterior tarsi are dilated at the base in some genera; the labium is thick, and terminated by large lips; the palpi long, and thickened at the tips; the setæ of the mouth minute (*fig.* 130. 15. mouth of Scenopinus); in some the antennæ want the seta; in others the seta is terminal, and in some dorsal; the veins of the wings are few in number compared with the other groups of Tanystoma.

The tribe is of difficult location, but it appears to me that it is at the confines of the Tanystoma and Athericera that the groups of which it is composed ought to be arranged; the determination of this point will depend in a great measure upon the nature of the transformations of the insects. We learn, therefore, from Bouché's figures of the larvæ and pupæ of Scenopinus senilis, that it is a Tanystomatous insect, the larva so exactly resembling that of Thereva plebeia (*fig.* 129. 20.), that I have not thought it necessary to refigure it. The pupa (*fig.* 130. 16.) is of the incomplete species, long, narrow, with the abdominal segments much constricted, and of nearly equal width; each of them is furnished with two rows of spinulæ, and the body is terminated by two long curved setæ; the head has two short horns in front. The larva was found in the rotten fungi of willows.

The larva of Platypeza boletina observed by M. Van Roser, and which he says resembles some seed (Gelbrubensaamen, *Wurt. Dipt.* p. 11.), resides in rotten mushrooms. I am indebted to him for a specimen of the larva represented in *fig.* 130. 17.; it is flat, with the sides of the body furnished with curved rigid setæ. I should conceive that the pupa would be a coarctate one.

The fourth stirps of the Diptera, or the ATHERICERA of Latreille, has the antennæ composed of two or three joints, the last of which is never annulated, but is terminated by a style or seta; the proboscis is generally elongated, thick, and membranous, with two large labial lobes; it is elbowed near the middle, with the palpi (which are composed of a single piece, and entirely concealed when inactive) inserted a short distance before the bend of the proboscis, which is

generally completely withdrawn (when at rest) into the oral cavity; occasionally (as in the Conopsidæ) it is porrected; but there are only two, or at most four (as in the Syrphidæ*), lancet-like organs. In the Bot flies (Œstridæ) the mouth is generally entirely rudimental.

The larvæ are soft fleshy grubs, with the body very contracted, and ringed, without any appearance of legs; the front part is attenuated; the head is of a variable figure, and its external organs consist of one or two unguiform appendages, accompanied occasionally by fleshy lobes, and probably in all, by a kind of tongue destined to receive the nutritious fluids upon which it feeds. These larvæ undergo the coarctate kind of metamorphosis, never shedding the skin in which they are enclosed at the period of their exclusion from the egg, and which hardens and becomes, when the larva has attained its full size, a kind of cocoon in which the pupa is enclosed; this is effected in the following manner: the larva by degrees contracts itself and becomes much shorter, assuming an oval form; the anterior part, which before was narrow, increases in thickness, and is sometimes even larger than the opposite extremity of the body; the segments become more and more indistinct until the insect appears under the form of an oval chestnut-coloured mass, in which scarcely any traces of rings or spiracles are visible. The body of the enclosed insect is detached by degrees from the inner skin of this cocoon or puparium, as it may be considered, and appears under the figure of a very soft elongated mass, in which none of the parts of the future insect are at first visible; it soon, however, assumes the appearance of a pupa, in which the rudimental limbs are traceable. From this cocoon the perfect insect escapes by scaling off the interior part of the case, which it detaches by repeated efforts of the head, having also cast off the pellicle in which it was encased whilst a pupa.

These insects in the perfect state are attached to flowers, leaves, &c., very few being carnivorous, or feeding upon other insects.

This stirps comprises the Linnæan genera Conops, Œstrus, and the greater portion of Musca; amongst the latter, a great number of species were placed by Linnæus, the proboscis of which encloses four lancet-like organs (including the Syrphidæ), instead of two, as in all the other Athericera, furnished with a proboscis.

* Hence Macquart, relying on the structure of the mouth, arranges this family amongst the tribes which have an incomplete instead of a coarctate pupa.

The stirps may, therefore, be divided in the following manner:—

Section 1. Proboscis with four internal pieces. (Fam. Syrphidæ.)
Section 2. Proboscis enclosing two pieces. (Fam. Conopsidæ, Muscidæ.)
Section 3. Proboscis rudimental. (Fam. Œstridæ.)

A connexion between the Syrphidæ and Conopsidæ is thus effected by means of such genera as Ceria and Conops; and the communication between the Conopsidæ and Muscidæ, by means of the genera Stomoxys and Bucentes, as indicated by Latreille, is adopted. The Œstridæ are not further removed from the Pupipara than the genus Phora, with which the true Diptera are generally terminated. Indeed the imperfect structure of the mouth of the Œstridæ appears to point out the propriety of placing them at the end of the order. In their parasitic nature they are also nearer to the Hippoboscidæ than any of the preceding Diptera.

The family SYRPHIDÆ*, composed for the most part of portions of the Linnæan genus Musca, is distinguished from the preceding families by the nature of its transformations, noticed above, and from the remainder of the Athericera in having the mouth more perfectly organised (*fig.* 130. 18. Syrphus Pyrastri); the proboscis is long, membranous, elbowed near the base, terminated by two large labial lobes, and enclosing in a channel on the upper surface four setæ, viz. a long horny upper lip, hollow, and notched at the tip; a pair of slender acute maxillæ, and a slender acute tongue; at the base of the maxillæ are also attached a pair of small inarticulate palpi, thickened at the tips (*fig.* 130. 19. mouth of Syrphus); the head is hemispherical, and generally covered for the greatest part by the eyes, especially in the males; the front of the head is often produced into a kind of beak, hollow beneath; it is mostly short and broad, but sometimes elongated, cylindrical, or clavate at the tip, receiving on its under side the trophi when at rest; the antennæ (*fig.* 130. 20.) are 3-jointed, the third joint being the largest, dilated, oval or reniform, &c., without any traces of articulation, and emitting a seta articulated at the base and sometimes plumose (*fig.* 131. 3. ant. of Volucella); the abdomen is never incurved at the extremity; the wings are much more

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* BIBLIOGR. REFER. TO THE SYRPHIDÆ.

Macquart. Diptères du Nord de France (Syrphies), 8vo. 1829.
And the general works on the order.

nerved than those of the Muscidæ, having several perfect cells, the nerves closing the apical cells run parallel to the posterior margin of the wings; the hind legs in many species are thickened and toothed. I have observed in some of the Helophili (whilst experimenting on the origin of the buzzing of these insects) an organ not hitherto noticed, connected with the thoracic organs of respiration, and the instruments whereby the buzzing is produced; this consists of a slender elongated filament clothed with very long and delicate hairs, fixed near the under side of the alula at its base, and at a little distance from the base of the balancer.

These insects are either of a moderate or large size, and generally of variegated colours; they are very numerous, many species so much resemble humble bees, wasps, and other Diptera, that they are constantly mistaken for them by the inexperienced. In one genus, Volucella* (*fig.* 131. 2. Vol. mystacea), this similarity to the humble bees is of eminent service to the insects which deposit their eggs in the nests of those bees, an admirable provision of nature, since, as Messrs. Kirby and Spence observe, "Did these intruders venture themselves among the humble bees in a less kindred form, their lives would probably pay the forfeit of their presumption."

This family is of considerable extent, upwards of thirty genera, including more than 100 species, having been recorded as indigenous. In their perfect state they are particularly partial to flowers, especially such as are syngenesious. They fly with amazing rapidity, and many delight to hover immovably over certain spots, to which they will return, if disturbed for a considerable number of times.

The typical genera are interesting on account of the peculiarity of their habits, the larvæ feeding upon Aphides, amongst which the parent Syrphus has the instinct to deposit her eggs singly, so that the young are hatched in the midst of their food, which is soon devoured by these foes, which have but to extend their bodies in order to obtain a fresh victim. They are apodal grubs, destitute of eyes, and which have the mouth armed with a peculiar organ for suction, carefully described by Réaumur (*fig.* 130. 21. larva of Syrphus Pyrastri); when full grown, which takes place in summer in a short time, the larva

* Saint Fargeau has made some interesting observations on the occasional connection of the opposite sexes of allied species of this genus, and the supposed productions of hybrid individuals resulting therefrom. (*Encycl. Méth.* tom. x. p. 785.; *Règne Animal*, tom. v. p. 490.; *Bulletin Sci. Nat.* Oct. 1828.)

attaches itself by a glutinous secretion to the leaves or stems of plants, its body then contracts and hardens (*fig.* 131. 1.), and the insect assumes the pupa state within the larva skin. De Geer (*Mém.* tom. vi. tab. 6.) figures the transformation of Syrphus Ribesii and Pyrastri, the larva of the latter of which is much more transversely wrinkled than the former. In pl. 7. he has figured the transformations of another species, the larva of which is armed with transverse rows of strong spines. See also Réaumur's memoir on the enemies of the Aphides (*Mém.* tom. iii. and pl. 30, 31.), in which he has illustrated several species. Bouché has figured the larvæ and pupæ of Syrphus bal-

Fig. 131.

teatus and tæniatus (*Naturg.* tom. v. fig. 1—6.); other species have been illustrated by Rösel (*Ins. Belust. Musc.* tab. 6.), and Schäffer (*Abhandl.* vol. iii. tab. 13.), Albin (*Ins.* pl. 63. and 66.), Swammerdam (*Book of Nature*, tab. 45. fig. 26—30.), Vallot in *Annales Soc. Ent. France*, 1834, p. 65. App. (S. balteatus and Pyrastri). The larva of Ceria Conopsoides, observed by Van Roser (*Verz. Wurtemb. Dipt.* p. 9.), resembles that of Syrphus.

The larvæ (*fig.* 131. 4.) of the genus Volucella, above mentioned, are also insectivorous, but reside in the nests of Bombi and Vespæ, upon the larvæ of which they subsist; they have the body long, narrowed in front, transversely wrinkled, with fine lateral points, and the tail armed with six radiating points; the mouth is armed with two bifid mandibles, and with three pair of tentacula. The pupæ of this genus have not been described, De Geer figuring only the larva and imago of V. bombylans (*Mém.* tom. vi. tab. 8. fig. 4—9.; and see Réaumur, *Mém.* tom. iv. pl. 33.). All the species are not, however, insectivorous, some feeding upon vegetable matter, and being either terrestrial or aquatic. Amongst the former are the species of Mi-

lesia, Criorhina, and Xylota, the larvæ of which live in the detritus of wood, as does also that of Chrysotoxum arcuatum, observed by Van Roser. That of Milesia vespiformis has been observed by Baumhauer; it is thick, nearly oval, and of a reddish grey colour. The pupa of Criorhina apicata was discovered by Schrank; it is brown, convex above, flat beneath, the head furnished with two maxillary tumours, and the body terminated by a small tail. It closely resembles that of Xylota pigra, of which the exuvia alone has been observed, and which is also probably found in rotten wood. The pupa, or rather the puparium, of Xylota Florum, communicated to me by M. Van Roser, is short, and very much swollen, with two short appendages in front, the extremity of the body armed at the sides with short spines, and terminated by a short cylindrical tail (*fig.* 131. 5.).

The larva of Merodon clavipes was found by Réaumur (*Mém.* tom. iv. pl. 34.) and Van Roser in the bulbs of Narcissi, of which it devours the inside. It has the body (*fig.* 131. 6.) whitish, thick, cylindrical, rather pointed at each end; the mouth is furnished with two scaly hooks, above which are two short bifid horns; the extremity of the body has two stigmata placed posteriorly upon a short footstalk, and two pointed tubercles; the real pupa is oval, with two anterior horns connected with two vesicles which communicate with the spiracles. Messrs. Serville and Saint Fargeau have confirmed these observations (*Encycl. Méth.* tom. x. p. 525.); Bouché has figured the larva and pupa of Merodon Narcissi (*Naturg.* pl. 5. f. 7—11.).

The pupa of Cheilosia ruficornis has been found at the root of a tree by Fallen, who has not, however, described it; and the larva of Syritta (Xylota) pipiens in horse-dung by De Geer; it is thicker in front than behind, with a small point on the head. That of Rhingia appears to reside in cow-dung, Réaumur having found a full-grown specimen in a vessel filled with that material.

Van Roser found the larva of Milesia Oxyacanthæ in the rejectamenta of the river Neckar (*Verz. Wurtemb. Dipt.* p. 10.); that of Brachyopa bicolor in the exuding sap of trees, and that of Syrphus scutellatus in rotten fungi. (*Ibid.*)

The larvæ of Eristalis and Helophilus (*fig.* 131. 7. larva of H. tenax) differ materially from those of the rest of the family, not only in the situations in which they reside, but also in their structure, fitting them for their peculiar mode of life. It is in stagnant water and muddy

places that they reside, and as it is generally at a considerable depth from the surface, the hind part of the body is furnished with a very long and slender tube, which serves as an organ of respiration; hence they have obtained the name of rat-tailed larvæ; the mouth is surrounded by a cartilaginous margin, enclosing a conical fleshy organ; the under side of the body is furnished with seven pairs of membranous feet, provided with small hooks, being the only instance of such appendages which occurs in the order. When full grown they quit the water and bury themselves in the earth; their body shortens, hardens, and becomes the puparium, in which their organs of respiration consist of four small horns placed in the front part of the body (*fig.* 131. 8, 9. represents the pupa extracted from the puparium). Réaumur (*Mem.* tom. iv. pl. 30—32) has illustrated the transformations of several species of these rat-tailed larvæ, as has also Swammerdam (*Book of Nature*, pl. 38. fig. 9. N. B.).

In the works of Latreille we find various methods of distribution of these insects into sectional and subsectional groups, differing according to the organs selected to characterise the division, as, for instance, the length of the antennæ and of the proboscis, the prolongation of the nasus, &c.

The family Conopsidæ, formed of the genus Conops of Linnæus (*fig.* 131. 10. Conops flavipes), is particularly distinguished by having the proboscis long, and always exserted, elbowed, and siphon-shaped, either cylindric, conic, or setaceous (*fig.* 131. 12. rostrum of Conops); the mandibles and maxillary lancets are obsolete, those representing the upper lip and tongue only remaining; the palpi are minute and inarticulate; the reticulation of the wings is nearly similar to that of the typical Muscidæ; the antennæ have the seta very short, and either terminal (*fig.* 131. 11. ant. of Conops) or dorsal (as in Myopa); the abdomen is generally incurved at the extremity, with the male organs of generation exposed. These insects are generally prettily coloured, and are met with upon plants and flowers. The species are parasites in the larva state upon bees, as first discovered by Baumhauer. Latreille also states that the Conops rufipes undergoes its transformations in the interior of the abdomen of living humble bees, escaping at the margin of the segments, having reared four specimens

of the Conops in a box in which he had placed some of the Bombi; and Messrs. Lachat and Audouin have published an interesting memoir upon an apod larva found in the intestines of Bombus lapidarius *Linn* (Apis), which Latreille attributed to this species of Conops. This larva was very soft, whitish, 11-jointed, with a long neck and a mouth armed with lips and hooks, and an anus vertically slit, and two lateral elevated plates supporting the two spiracles. (*Mém. de la Soc. d'Hist. Nat. de Paris*, tom. i.) M. Robineau Desvoidy has also observed a species of Conops pursuing a Bombus with great patience, and flying on it several times (*Comptes Rendus de l'Acad.* No. 23. 1836), as has also M. Dufour, who, moreover, possesses a Bombus terrestris, from the anal part of which a Conops rufipes is dependent, the swollen extremity of the abdomen of the latter being retained within the former. (*Ann. Sc. Nat.* Jan. 1837.) I have also frequently observed Myopa atra flying about sand-banks in which were the burrows of various bees. Latreille has united to this family several small genera, which Meigen formed into a distinct family, Stomoxidæ, having nearly the appearance of the common fly, to which they are allied in the structure of the antennæ, abdomen, and wings; the proboscis is, however, porrected and elbowed once or twice. Nitzsch has described a minute insect, which he refers to this family, under the name of Carnus hemipterus, of the size of a flea, with minute rudiments of wings, which is parasitic on the birds of the genus Sturnus. (Germar's *Mag.* No. 3. p. 306.)

The family MUSCIDÆ *, corresponding with a portion only of the genus Musca of Linnæus, or with that genus as restricted by Fabricius (*fig.* 131. 13. Echinomyia grossa), is distinguished from all the other

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Athericera by having the proboscis distinct, short, thick, membranaceous, terminated by two large labial lobes, and entirely retractile within the oral cavity, enclosing only two internal setiform organs*, and a pair of palpi† (*fig.* 131. 15. head and mouth of Musca); the antennæ are triarticulate, the third joint being the largest, and furnished with a dorsal seta, chetum, or arista, sometimes articulated at the base (*fig.* 131. 14. antenna of Echinomyia); the body is generally short and robust, and the legs and wings of moderate length; the nerves of the latter are much fewer in number than in the Syrphidæ, and extend to the posterior extremity of the wings; the abdomen is not inflected at the extremity.

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Zetterstedt, in Ann. Soc. Ent. de France, tom. iv. 1835 (Scandinav. Scatophaga).

And the general works of *Fabricius, Meigen, Macquart, Wiedemann, Haliday, Perty.*

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* In Diopsis, however, I have discovered a pair of maxillary lancets, and Mr. Curtis also detected them in Lucina, Sapromyza, Borborus, and Drosophila.

† In Phora the palpi are not concealed.

The insects of this family are of small and moderate size, and of very variable habits; the larvæ feeding upon various substances both animal and vegetable, and both in a dead and living state. These larvæ are in general apod, soft, vermiform, annulated grubs, of a cylindrical-conic form, attenuated in front, and thickened and obtuse behind, with a head of variable form, furnished with two retractile hooks; the terminal segment of the body, in many, and also that immediately succeeding the head, furnished with two spiracles, in some species inserted upon horn-like appendages. The pupa, which is very immature in its form, with a swollen head (Réaumur, *Mém.* tom. iv. pl. 21.; Westwood, in *Mag. Nat. Hist.* March, 1835), is enclosed within the contracted and indurated skin of the larva, which sometimes assumes the form of an oval horny exarticulate mass, but in other species retains more of its former appearance. De Geer (*Mém.* tom. vi. tab. 1—6.) and Réaumur (*Mém.* tom. iv.) have figured the transformations of various species of this family; but it is difficult, if not impossible, to determine with precision the insects represented by them.

Some idea of the extent of this family may be obtained, from Meigen having described nearly 1700 European species; and about the same number (belonging, however, only to a portion of this family, and forming upwards of 350 genera), having been described by Robineau Desvoidy, in his *Essai sur les Myodaires*, a quarto volume of 812 pages, most of which species are extra-European. In England 700 or 800 species have already been recorded, which is probably not more than two thirds or one half of the actual number of indigenous species.

Hence, as well as from the great diversity in the structure and habits of the numerous tribes of which the family is composed, it is not surprising that the study of the Muscidæ is attended with great difficulty, and can scarcely indeed be said at present to be more than commenced. The works of Latreille, Meigen, Fallen, Wiedemann, Desvoidy, and Macquart, have done much to reduce this immense mass to something like order; but the difficulties attending the subject are far from being smoothed, nor can the arrangement of these tribes be perfected until we are better acquainted with the habits and transformations of many of the groups.

It is to Latreille, Fallen, Desvoidy, and Macquart, that we are indebted for the attempts which have been made to establish subfamilies and other sectional groups, facilitating the study of the species; but these groups differ in extent in the works of these

authors in consequence of the adoption of various characters as of primary importance.

The corrected arrangement of these insects, as given by Fallen (*Diptera Sueciæ*, vol. ii. p. 1. 1818—1825), is as follows:—

Area alarum angularis. Nulla seta antennarum dorsalis in (Hydrocho subterminalis).

A. Proboscide vix ulla.

Fam. 12. *Hæmatomyzides.* (Corpus polymorphum.) Gen. Stomoxys, Œstrus, and Hippobosca.

B. Proboscide distincta.

* Squama sub alis magna.

Fam. 13. *Rhizomyzides.* Oculi oblongi. Os mystaceum. Nervus alarum costalis, cum nervo tertio longitudinali connexus. Gen. Phasia (*Thereva* Fall.) Ocyptera.

Fam. 14. *Muscides.* Oculi oblongi. Os mystaceum. Nervus alar. costalis cum nervo quarto longit. connexus. Gen. Tachina (74 sp.), Musca, (133 sp.), Lispe.

** Squama sub alis parva.

a. Palpi simplices.

Fam. 15. *Scatomyzides.* Oculi rotundi. Os mystaceum. Antennæ truncatæ. Gen. Scatomyza (Scatophaga), Cordylura.

Fam. 16. *Sciomyzides.* Os nudum. Nervus alar. auxiliaris à secundario remotus. Gen. Sepedon, Tetanocera, Sciomyza, Dryomyza.

Fam. 17. *Ortalides.* Os nudum. Nervi alar. auxiliaris et 2us. approximati. Gen. Tetanops, Tephritis, Ortalis, Sepsis, Palloptera, Lonchæa, Lauxania, Sapromyza.

Fam. 18. *Opomyzides.* Os nudum. Nervi auxil. et secundar. coadunati. Calobata, Tanypeza, Chyliza, Loxocera, Scatophaga, Tetanura, Opomyza.

Fam. 19. *Heteromyzides.* Os mystaceum. Antennæ rotundatæ, subsessiles. Heteromyza, Helomyza, Copromyza, Piophila.

Fam. 20. *Geomyzides.* Os mystaceum. Seta antennarun pectinata. Nervus alar. auxil. brevis, simplex. Gen. Geomyza, Drosophila.

Fam. 21. *Oscinides.* Os nudum. Antennæ rotundatæ. Nervi alar. transversi approximati. Gen. Platycephala, Oscinis, Madiza, Gymnopa.

Fam. 22. *Agromyzides.* Os submystaceum. Antennæ l. rotundæ, l. angulatæ. Nervus transv. ordin. l. in medio, l. paullo pone medium alæ situs. Gen. Heteroneura, Agromyza, Anthomyza, Chlorops.

Fam. 23. *Phytomyzides.* Os sæpius nudum. Antennæ rotundæ. Nervi transversi ad basin alæ retracti. Gen. Dipsa, Phytomyza, Trineura.

Fam. 24. *Ochtidiæ.* Antennæ angulatæ porrectæ. Nervus alar. auxiliaris brevis. Phyllomyza, Ochtiphila.

B. Palpi dilatati.

Fam. 25. *Hydromyzides.* Oculi rotundi. Antennæ deflexæ. Corpus ovatum. Gen. Hydromyza, Ochthera, Ephydra, Psilopa, Notophila.

(Fam. 26. *Dolichopodes*).

We have already seen that in respect to their transformations the Dolichopodes do not enter amongst the Muscidæ, whilst the family Hæmatomyides is as unnatural a group as could well be conceived.

The arrangement of Robineau Desvoidy differs materially from that of Fallen, and is founded not only on the characters of the imago, but on the habits of the larva. It is as follows: —

1. *Calypteratæ.* Chetum distinctè 3-articulatum. Calypta (the alulets) majora. Nervus transversus cellulæ γ C, semper manifestus. Corpus breve, grossum, nigrum, nigro-nitidum, nigro-ferrugineum. Larvæ in fimetis, radicibus, cadaveribus, insectorumque larvis. Œstrus, Echinomyia, Syphona, Tachina, Ocyptera, Gymnosa, Myopa, Trichopoda, Xysta, Phasia, Dexia, Prosena, Stomoxys, Musca, Mesembrina, Achias, &c.
2. *Mesomydæ.* Chetum obscurè triarticulatum. Calypta jam minora. Nervus transversus cellulæ γ C, haud manifestus. Corpus medium nigrum, nigro-griseum, nigro-cinereum. Larvæ in foliis, radicibus, stipitibus, et fungis. Anthomyia, Lispe, Drymeia, &c. &c.
3. *Malacosomæ.* Chetum obscurè triarticulatum. Calypta minima. Nervus transversus ut ad Mesomydas. Corpus oblongum, flavescens, flavum, flavo-pallidum. Larvæ in fungis, in putridis, stercoribus, inque plantarum medulla interiore. Thryeophora, Scatophaga, &c.
4. *Palomydæ.* Chetum sæpius quasi inarticulatum. Calypta quasi nulla. Nervus transversus ut ad Mesomydas. Alæ angustiores. Corpus oblongum necnon et filiforme, brunneo-flavescens, flavicans. Larvæ in plantis humidis, littoralibus, aquaticis. Loxocera, Sepedon, Tetanocera, Dyctia, &c.
5. *Phytomydæ.* Chetum quasi inarticulatum. Calypta nulla. Nervus transversus ut ad Mesomydas. Corpus politum, delicatulum, sæpius filiforme, nigro-nitidum, nigro-flaveolum. Larvæ in plantis et fructibus interdum et in putridis. Oscinis, Calobata, Micropeza, &c.
6. *Aciphoreæ.* Chetum quasi inarticulatum. Calypta utpote nulla. Nervus transversus ut ad Mesomydas. Alæ solito variegatæ. Corpus mediocre nigro-pallidulum. Anus ♀ solide stylatus et exterior. Larvæ in gallis corticalibus plantarum. Tephritis, &c.
7. *Napœllæ.* Chetum quasi inarticulatum tertio antenn. articulo sæpius orbiculato. Calypta nulla. Frons et facies sæpius quadratæ. Corpus parvum, atro-brunnicans. Larvæ in putridis vegetalium animaliumque. Ochthera, Sphærocera, &c.
8. *Micromydæ.* Chetum simplex. Calypta quasi nulla. Nervus transversus cellulæ γ C, nullus. Corpus parvum, brunneum, brunneo-flavum, flavum, flavo-pallidum. Terebra ♀ interior. Larvæ in floribus, seminibus, et in Erucis. (Not yet described in detail).
9. *Muciphoreæ.* Chetum quasi inarticulatum. Calypta utpote nulla. Nervus transversus cellulæ γ C, nullus. Corpus parvum delicatum, flavescens, pallidulum. Larvæ in succis putridis vegetalium animaliumque. (The details of this stirps not yet published).

Each of these tribes is subdivided into a great number of minor sections and an immense number of genera, founded in many instances upon very trivial characters. Another great objection to the work of Robineau Desvoidy consists in his negligence in not citing the works of Meigen and Fallen, and his continual substitution of his own new names for the long-established specific names of Linnæus and Fabricius. Latreille also (*Règne An.* tom. v. p. 509.) objects to the distribution proposed as above, with the exception of the group Calypteratæ, which he asserts to be equivalent to the first section of the family, which in his *Familles Naturelles* he had proposed under the name of *Creophila.* This assertion is not, however, correct, because Robineau Desvoidy first introduced (and as it appears to me naturally) into this family and tribe, Stomoxys and the allied genera, which Latreille always arranged with Conops; and secondly, because R. Desvoidy also added to the Calypteratæ the family Œstridæ, which Latreille always (and naturally) kept distinct. With these exceptions, the two groups are nearly identical. The Mesomydæ *R. D.* also nearly correspond with Latreille's 2d section, *Anthomyzides.* The 3d group, Malacosomæ of *R. D.*, forms part of Latreille's 4th section, *Scatomyzides;* other portions of which last, together with Latreille's 5th section, *Dolichocera,* form the Palomydæ *R. D.*, whilst the Phytomydæ *R. D.* consist of still further portions of Latreille's Scatomyzides, and his 6th section *Leptopodites.* The Aciphoreæ *R. D.* form part of Latreille's 7th section, *Carpomyzæ;* and the Napæellæ *R. D.* nearly correspond with Latreille's 3d section, *Hydromyzides.* Latreille has proposed two additional sections in the *Règne Animal:* namely, the Gymnomyzides, composed of the genera Lauxania, Homalura, Gymnomyza, &c.; and Hypocera, composed of the single anomalous genus Phora.

M. Macquart, in his *Hist. Nat. d. Diptères,* has sought to simplify the arrangement of these tribes, and at the same time to combine the views of his predecessors in the following distribution:—

Section 1. *Creophiles,* having a biarticulate or triarticulate style to the antennæ, large alulets, and with the first posterior cell of the wings closed or nearly closed, corresponding with Latreille's Creophila, with the addition of Stomoxys, &c. with Robineau Desvoidy's Calypteratæ, after the removal of Œstrus and Myopa, and with Fallen's Rhizomyzides and Muscides.

Section 2. *Anthomyzides,* having an inarticulate style to the antennæ, the first posterior cell opened, the front narrow, and the alulets small or moderate-sized,

and corresponding with the Anthomyzides of Latreille, and the Mesomydæ of Robineau Desvoidy.

Section 3. *Acalypteres*, differing from the Anthomyzides in having the front broad in both sexes, and the alulets rudimental or wanting, and corresponding with Latreille's seven terminal sections, as well as with the seven terminal groups of Robineau Desvoidy.

The third section is divided, however, by Macquart into seventeen subtribes; namely, Dolichocères, Loxocérides, Cordylurides, Scatomyzides, Psilomydes, Ortalidées, Tephritides, Sepsidées, Leptopodites, Thyreophorides, Ulidiens, Lauxanides, Hydromyzides, Piophilides, Sphærocérides, Heteromyzides, and Hypocères, of which subtribes Macquart might well remark, that they "étonnent l'imagination par l'infinité des modifications dans les organes et dans les mœurs." (*Op. Cit.* tom. ii. p. 357.) The anomalous genus Lonchoptera (*fig.* 132. 15. wing) is also placed in this family by Latreille and Fallen, but Meigen and Macquart form it into a distinct family.

In the following account of the transformations of these insects, I have adopted the arrangement of M. Macquart, as being the most recent and most complete yet published.

The Tachinides are parasitic upon other insects, the females depositing their eggs upon the bodies of caterpillars, &c. whence the name Musca Larvarum, given to the typical species, and the young larvæ penetrating into the body as soon as born, where they subsist upon the adipose matter so abundant in the interior, thus resembling the Ichneumonidæ. It was long ago observed by Godart and other early naturalists, that these flies were produced from the caterpillars and chrysalides of Lepidopterous insects; and Serville has reared as many as eighty specimens from a single larva of Acherontia Atropos. Other species were observed by Réaumur and De Geer, but recent observations have proved that the other orders of insects are similarly subject to these attacks.

L. Dufour has given the details of a species of Tachina, which he reared from a larva found in the intestines of Cassida viridis, one of the tortoise beetles, as well as of Ocyptera bicolor, which he reared from Pentatoma grisea. (*Ann. de Sci. Nat.* March, 1827.) The larva of the latter (*fig.* 131. 16.) has the body terminated by a long caudal siphon (*fig.* 131. 17. head, and 131. 18. apex of siphon of this larva, 131. 19. puparium of the same species). M. Von Winthem has observed that Tachina pacta is parasitic upon Carabus gemmatus and

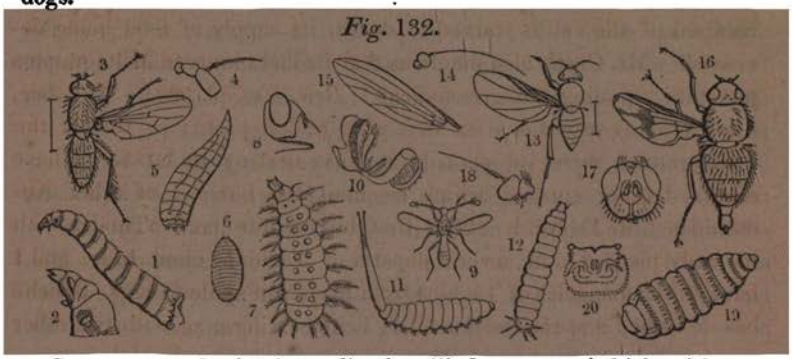
violaceus. (*Isis*, 1831, No. 7.) M. St. Fargeau has also observed a species of Myobia emerging from the body of one of the Curculionidæ (according to Macquart). The same author has also observed various species of these insects unceasing in their endeavours to deposit their eggs in the nests of various Hymenoptera, already provisioned with the bodies of other insects, upon the store of provisions in which the parasitic larva, first hatched, is fed; and thus the real inhabitant of the cell is starved to death, its supply of food being devoured. Mr. Curtis also mentions that he had observed Miltogramma punctata pursuing Colletes fodiens. (*Brit. Ent.* pl. 529.) The bee, however, only provisions its nest with pollen paste; so that, if the Miltogramma were its parasite, it must destroy its larva. I have observed other species, which frequent the burrows of other Andrenidæ. R. Desvoidy states that he has observed a spider with its body pierced, and several puparia of Tachinæ close to it; and I have reared a species of Tachina from masses of spiders' eggs. Bouché has described a species of Tachina (T. inflexa, forming, with two other species, a distinct subgenus, Compsilura), the larva of which is parasitic in the larva of Tenthredo grossulariata. The larvæ of Ta. concinnata (Bouché, *Naturg.* tab. 5. f. 15., and my *fig.* 131. 20.) have the segments much constricted, and of nearly equal thickness throughout; the head is very small; the last segment bears two spiracles, and is much smaller than the preceding segment (*fig.* 131. 21. represents one of the prothoracic spiracles). Robineau Desvoidy states that he possessed the pupa of one of these insects, which lived in the body of one of the Noctuidæ, but which was in its turn filled with a great quantity of the larvæ of smaller Myodaires.* This author has proposed a variety of interesting questions as to the habits of the Tachinidæ, and especially with reference to certain species or tribes being appropriated to particular groups or species on which they are parasitic. (See also Gimerthall on the transformations of various species of Tachina, in *Bull. Soc. Naturalistes de Moscou*, 1829, No. 4, 5.; Réaumur, *Mém.* tom. ii. pl. 36.)

Sarcophaga (S. carnaria, the flesh-fly, &c.) and the allied genera are very peculiar in their mode of development. The female being viviparous, the ovaries are of very large size, and arranged in a spiral

* In the *Mag. of Nat. Hist.* No. 25. is a notice of the parasitic larvæ of Tachina Larvarum, being subject to the parasitic attacks of Pteromalideous insects.

manner, in which the larvæ are developed, sometimes to the number of 20,000. (De Geer, *Mém.* tom. vi. pl. 3. fig. 5—18.; Réaumur, *Mém.* tom. iv. pl. 29.) It is upon animal matter, as well as upon other substances in a state of decomposition, that these young larvæ are deposited. Bouché has described the larvæ of several species. Those of the genus Cynomyia have only been found on the dead bodies of dogs.

Fig. 132.



Stomoxys and the immediately allied genera (which, although ordinarily arranged with the Conopidæ, are in all respects, except the mouth (*fig.* 132. 8. head and geniculated mouth of Siphona), most closely allied to the typical Muscidæ) frequent our apartments, and are remarkable for their habit of piercing our flesh, even if covered by clothes, for the purpose of sucking the blood. The larva of St. calcitrans, observed by Bouché, lives in horse-dung, and closely resembles that of Musca domestica.

The species of the subgenera Lucilia (Musca Cæsar, the blue-bottle fly) and Calliphora (Musca vomitoria, the meat-fly, &c.) have the instinct to deposit their eggs (well known under the name of fly-blows) upon meat and other dead animal matter.* The larvæ are soon hatched, and are of an elongated conical form, pointed to the head, which is furnished with two fleshy horns, and the mouth is furnished with one or two corneous hooks; the hind part of the body is truncated, and furnished with a pair of spiracles in Lucilia, and with three pairs in Calliphora. When the period of transformation is arrived, these larvæ descend into the ground, where they assume the pupa state, enclosed in their own larva skin, which is hard, short, and desti-

* Numerous instances have been recorded of these and allied species depositing their eggs in the wounds of persons incautiously sleeping in the open air. (See Kirby and Spence.)

tute of any appearance of articulation. The entire development of these insects is effected in a very short time in the summer. Meigen has given some curious calculations as to the multiplication of these insects (vol. v. p. 20.). Rösel has given the details of the history of one of these meat-flies; the species, however, is difficult to be determined. (*Ins. Belust.* vol. ii. tab. 9, 10., Muscidum.) Mr. Newport has also given an excellent figure of one of these larvæ (art. *Insect*, in *Cyclop. of Anat.* p. 21., and my *fig.* 132. 1—2. anterior part of the body still more highly magnified), as has also Réaumur (tom. iv. pl. 12. fig. 1—9.). (See, also, the work of Keller on the domestic fly, with four plates, above referred to.)

The species of the subgenus Musca, as restricted to Musca domestica, the small common house-fly, are found more especially in houses, settling upon and sipping at almost every article of food. Their larvæ are found in dung, &c. as are also those of the Mesembrinæ. The larva of M. domestica is elongated, slightly attenuated in front, with a small head; and the terminal segment bearing a pair of spiracles, entire, and smaller than the preceding, without any radiating points. The larva of M. Hortorum is much thicker behind, with a larger head. Bouché has figured these larvæ, and has described those of several other species. De Geer has also given the details of the transformations of M. domestica. (*Mém.* tom. vi. pl. 4. fig. 1—10.)

The species of the genus Anthomyia and the allied genera undergo their transformations in rotten vegetable matter, or in manure, excrement, &c. Bouché has described the larvæ of many species of Anthomyia, some of which reside in cow-dung, and others in the roots of vegetables, such as onions, radishes, and other vegetable matter, earth, rotten leaves, &c. The species which feed on onions and other garden plants are occasionally very obnoxious. (See my memoir on Anthomyia Ceparum in *Gardener's Mag.* No. 87.) *Fig.* 132. 3. represents this species, 4. its antennæ, 5. its larva magnified, and 6. its puparium. (See also De Geer, *Mém.* tom. vi. tab. 5. fig. 2—7.) Two other species, Anthomyia Brassicæ and Lactucarum, are also obnoxious to cabbage and lettuce plants. (See Bouché, and Kollar, *Obnox. Ins.*, transl., p. 160.)

Bouché has very properly separated from Anthomyia some species, the larvæ of which have the body much depressed, narrowed towards the front, with the sides furnished with long setose filaments.* To

* Fallen observes upon his Musca canicularis, "Larvæ *onisciformes* e stomacho hominum egressæ, ad hanc vel M. meteoricam forsitan pertinent?"

this group belong Anth. canicularis *Meig.* and scalaris *Meig.* Bouché found the larvæ of the former insect in rotten vegetables* and decayed cheese, and those of the latter in human excrement. The Rev. L. Jenyns has given a very detailed account of some of these larvæ, with lateral filaments (*fig.* 132. 7.), which were discharged from the intestines of a clergyman still alive, and which are assigned to Anth. canicularis. (*Trans. Ent. Soc.* vol. ii.) In the *Medizin. Correspondenzblatt* for 1832 an account is given of the occurrence of the larva of A. scalaris in the human body. In the *Memoirs of the Medical Society of London*, vol. ii. 1789, Dr. White also detailed the case of a patient who discharged similar larvæ, described, but erroneously, as those of Musca carnaria.† Swammerdam has selected one of these filamentous larvæ (being the offspring of the common fly of privies) to illustrate his fourth order of mutations. (*Book of Nature*, pl. 38. fig. 1—8.) Meigen refers this figure to Anthomyia canicularis.

The larva of Cænosia vaccarum *Bouché* lives in cow-dung, and resembles that of Musca domestica.

M. Robineau Desvoidy observed a female of the genus Lispe depositing its eggs upon the petals of a Nymphæa. Bouché, however, describes the larva of L. tentaculata as living in puddles of water (Pfutzen), and also in human excrement; it resembles that of Musca stabulans, but is more pointed in front.

The larvæ of the genus Pegomyia, or, at least, P. Hyoscyami, devour the parenchyma of the leaves of various plants, living between the two surfaces. Mr. Haliday informs me that a number of species are known to be fungivorous, as P. fulgens, &c. The mouth of these larvæ is furnished with a corneous instrument in the shape of S, which moves round a small fixed point, enabling them to scrape up the soft parenchyma of the leaf.

Amongst the Acalypteræ we find the habits of the majority agree-

* I have reared a species of Anthomyia from larvæ found in rotten fungi, closely resembling Réaumur's fig. 1, 2. pl. 13. tom. iv. the lateral appendages of which are bristles instead of membranous pilose filaments.

† The occurrence of these larvæ in the human intestines, although singular, may be satisfactorily accounted for in various ways; but at the meeting of the Entomological Society on the 4th of April, 1840, Professor Owen exhibited a Dipterous larva (distinct from that of Anthomyia canicularis, and wanting the lateral filaments), several of which had been discharged from the *urinary bladder* of a patient. See, also, other similar cases, noticed in Germar's *Mag* vol. iii. p. 419. The Rev. F. W. Hope has collected a great number of cases of these occasionally intestinal larvæ in his memoir on that subject.

ing with those of the Anthomyzides rather than with the Creophilæ; the larvæ feeding upon dead animal matter or upon plants, either alive or in a state of decomposition. The species of Scatophaga revel upon excrement, in which also they deposit their eggs, which are of an oval form, but have two broad divergent appendages at the upper end; the object of which appears to be to prevent them from sinking in the matter in which they are deposited. The larvæ of this genus are conical, broadest behind, with the last segment armed with twelve or fourteen fleshy points. (Bouché, *Naturg.* p. 93, 94.; see also Réaumur, *Mém.* tom. iv. pl. 27.)

The species of Sapromyza, as the name implies, are developed in animal matters in a state of decomposition, whilst the larvæ of Helomyza live in fungi; that of H. tuberivora, the largest species in the genus, inhabits the truffle. This larva, observed by Réaumur (*Mém.* tom. iv. pl. 27. fig. 13—16.), has two hooks at the anterior extremity, which, as well as the posterior extremity, bears two spiracles.

Bouché has observed the transformations of Sepsis cylindrica and Leachii, the larvæ of which reside by thousands in human excrement. They are cylindrical, attenuated in front, with the terminal segment conical, bearing two spiracles. The pupa is shorter, with the two spiracular appendages of the terminal segment elongated, with a short point on their upper side. Mr. Haliday informs me that the larva and pupa of S. cynipsea do not resemble Bouché's characters of the other species. They have the posterior extremity attenuated and forked, the spiracles terminating the branches; thus approaching the form of Ephydra.

The larva of Dorycera graminum is aquatic; it lives amongst the leaves of water plants, and is of a green colour. The pupa is brown, the front furnished with two small horns, and a tubercle is placed on each side, near the middle of the body. De Geer has figured the larvæ and pupæ of several subcutaneous species (*Mém.* tom. vi. tab. 5. fig. 8—16.), but omitting the perfect state.

The larva of Ortalis Cerasi feeds on the pulpi of the cherry (Réaumur, *Mém.* tom. ii. pl. 38.); that of Dacus Oleæ feeds on the olive, and often commits great injury. It is known to the natives of Provence under the name of Chiron; it is of a whitish colour; its mouth is furnished with two hooks; it at first feeds on the young leaves, but afterwards penetrates into the fruit. (See the memoirs of Passerini on this insect in the *Giornale Agrario Toscano*, No. 10.;

as well as a memoir by Briganti in the *Atti del Real Instit. di Napoli*, tom. iii. 1822.) A small but beautiful allied insect has been described in detail by Mr. MacLeay (*Zool. Il.* No. 16. 18.), under the name of Ceratites citriperda, the larva of which feeds upon the pulp of ripe oranges. The male is remarkable for possessing two minute clavate filaments on the crown of the head.

The females of many of the species of Tephritis, and the subgenera separated therefrom, deposit their eggs in growing plants by the assistance of their elongated ovipositor; causing also the production of galls of large size, in which the larvæ reside, and the flies are produced; such is especially Urophora Cardui. (Réaum. *Mém.* tom. iii. pl. 44, 45.; Swammerdam, *Book of Nature*, pl. 45. fig. 1.; Fallen in *Swed. Trans.* 1814, Monogr. Swed. Tephritides.) De Geer has also figured the history of two species of Tephritis. (*Mem.* tom. vi. tab. 2. fig. 6—18.)

The larvæ of other species are developed and reside in the parts of fructification of different plants, which they devour. Such is the case with Tephr. Arctii, which Mr. Curtis states to have been reared from pupæ found in the calyx of Centaurea Cyanus. Its larva is also stated to be found on Arctium lappa and Leontodon taraxacum. M. Blot has detailed the history of a genus allied to Tephritis, named Myopites, in *Bulletin de Sci. Nat.* September, 1828. I have reared two species of Tephritis from subcutaneous larvæ, namely, Tephritis (Euleia) Onopordinis, from celery leaves, to which it is very injurious, and Tephritis (Acidia) Artemisiæ, from the leaves of chrysanthemums. I have published a memoir on these two insects in the *Gardener's Magazine*, March, 1839. The larva of Trypeta continua, according to Bouché, lives in the berry of Rosa villosa; that of Psila Rosæ lives in the root of the carrot, to which plant it is sometimes very destructive. (See Kollar's *Obnox. Ins.* transl. p. 160.) The larvæ and pupæ of Phytomyza lateralis are found in the centre of the receptacles of Pyrethrum inodorum (corn feverfew), there being seldom more than one in each. Mr. Curtis has given no description of their preparatory states. The larvæ of Ph. flava are subcutaneous in the leaves of Scolopendrium vulgare (Doubleday, in *Entomol. Mag.* No. 14. p. 415.); those of P. obscurella in the leaves of the holly, and those of P. flaviceps in those of the woodbine. (Haliday, in ditto, No. 17. p. 147.) The cheese maggot, so well known for its remarkable saltatorial powers, is the larva of Piophila Casei *Fall.* Its habits and structure have been fully de-

tailed by Swammerdam (*Book of Nature*, pl. 43.), as well as by Kirby and Spence.

The larvæ of Drosophila cellaris inhabit fermented liquids, in cellars and similar places. They are white, and have the mouth armed with two corneous jaws. Mr. Haliday reared Drosophila funebris from pupæ found in boleti. The puparium figured by Curtis (*B. E.* p. 473.) is oblong-ovate, with two frontal horns, setose at the tip, and with two shorter anal appendages.

Borborus nitidus resides, in the larva state, in rotten fungi, as observed by M. Robert. (Macq. *Dipt.* tom. ii. p. 566.) Mr. Haliday has given a detailed description of the larva of Borborus equinus in his monograph on the Borborides, published in the *Entomol. Mag.* No. 14. It resembles that of Scatophaga stercoraria in general form. The terminal segment has the usual conic protuberances behind the anal cleft, and its margin bears a circle of smaller ones: the openings of the anterior and posterior tracheæ are of the usual form; the former fan-like, and each of the latter consisting of three oblong spiracles, surrounded by a dark ring. The larvæ of Ulidia demandata was observed by Bouché in old horse-dung, by thousands. (*Naturg.* p. 98.)

Oscinis Frit. is a small species, which commits great ravages in the barley crops of Sweden. Other species, allied to this insect, are injurious to wheat crops; such are Chlorops Pumilionis (Bjerkander, in *Trans. Acad. Stockh.* 1778, and Markwick, in *Linn. Trans.* vol. ii.), also Chlorops glabra (Westwood, in *Gardener's Magazine*, vol. xiii. p. 289.). Olivier, also, in his 1st *Mémoire sur quelques Insectes qui attaquent les Céréales* (Paris, 1813), has described several allied species which are injurious to wheat crops. The larvæ of another species, referred doubtingly by Macquart to the same genus (Musca Lepræ *Linn.*), is considered as the cause of the disease to which the negroes of South America are subject, named Elephantiasis.

Many of the species of Ephydra frequent salt marshy situations. The larva of the Silesian species, E. salinaria, was observed by Klug in great numbers in salt boilers (Salzsiederei). The larva is cylindrical, without feet, and the terminal segment of the body very long, and terminated by a long fork, the prongs of which support the spiracles at the tip; the puparium scarcely differs from the larva (my *fig.* 132. 11.; Bouché, *Naturg.* pl. 6. fig. 13.).

The larvæ of the genus Phora are supposed by Macquart to feed upon moist or decomposing substances; although Bouché states that

he had seen many specimens of the larva of Phora Sphingidis emerge from the body of a sphinx, and Mr. Carpenter found the larvæ of Phora atricapella (Curtis, *B. E.* p. 437.) hanging to the pupæ of Coccinella, which soon afterwards underwent their transformations. I have repeatedly observed, on disturbing the nest of the common brown garden ant, a very minute species of Phora hovering over and flying upon the ants. The larva of Phora Dauci (*fig.* 132. 12.) was, however, observed by Bouché in rotten radishes; it is cylindrical, somewhat narrowed in front, and the terminal segment has eight radiating pointed appendages, and also bears the two spiracles on its upper side. The perfect insect materially differs from the rest of the family in the neuration of the wings (*fig.* 132. 13. Phora—? 14. its antenna).

Amongst the exotic species of this family many exhibit remarkable variations of structure: of these, the more striking are the splendid Rutiliæ, from New Holland; the Indian genus Celyphus, in which the scutellum is dilated into an immense semi-hemispherical mass, covering the body, as in the Scutellaræ; the genus Diopsis has the sides of the head extended into a pair of long inarticulate horns, at the extremity of which the eyes and antennæ are placed (*fig.* 132. 9. Diopsis Meigenii, 10. mouth of D. Sykesii). Wiedemann has described some allied and equally singular genera, chiefly from Brazil; and Diateina Holhymeniöides *Westw.* (Microtoma Peleterii *Lap.*) has exceedingly long legs, and antennæ considerably longer than the body, greatly resembling the Hemipterous genus Holhymenia.

The family of the Bot flies, ŒSTRIDÆ*, corresponding with the Linnæan genus Œstrus (*fig.* 132. 16. Gasterophilus Equi), is distin-

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* Bibliogr. Refer. to the Œstridæ.

Linnæus. Om Renarnas brömskulor (Œstr. Tarandi), in Vetensk. Acad. Handl. 1739; and in Act. Soc. Upsal. 1741.

Treiwald. Ytter ligare Ron, &c. Experiments on Œstr. Tarandi, in Vet. Acad. Handl. 1739.

Arture. Observ. sur l'Esp. de Ver nommé Macaque, in Mém. Acad. Sci. Paris, 1753.

Modeer. Styng-flieg slägtet (Monogr. Œstrus, 10 sp.), in Vetensk. Acad. Handl. 1786.

Fischer, J. L. Observ. d. Œstr. ovino atque bovino, 4 pl. 4to. Leipsic, 1787; and in Werner's work on intestinal worms, 8vo. Leipsic, 1788.

Bracy Clark. Observ. on the g. Œstrus, in Trans. Linn. Soc. vol. iii. 1797. —

guished from all the other Athericera by having the mouth completely obsolete, no other traces being visible except two or three minute fleshy tubercles (*fig.* 132. 17. front of head of Gast. Equi), except in the genus Cephenemyia *Latr.* (Œstr. Trompe), in which both the palpi and proboscis are visible. In Cuterebra, also, the proboscis is distinct and retractile. The antennæ are very short; the terminal joint rounded, and emitting a dorsal seta, thickened and articulated at the base (*fig.* 132. 18.); the wings are divaricate, the alulets very large, hiding the balancers. The nervures are few in number, in some they extend to the tip of the wing, as in Gasterophilus Equi; in others they form cells, having the external nerve running parallel to the margin of the wing. These insects, whose habits are so formidable, and whose economy is so extraordinary, have the appearance of large hairy flies, the hairs being often coloured in transverse bands.

Malpighi, Vallisnieri, Réaumur (*Mém.* tom. iv. mém. 12. pl. 34—38., and tom. v. pl. 9.), De Geer (*Mém.* tom. vi. tab. 15.), and Fischer devoted considerable attention to the elucidation of the natural history of this genus, but it is to our own countryman, Bracy Clark, that we are indebted for a history of many of the species of this family, which leaves nothing farther to be desired.

Each species of Œstrus is parasitic upon a peculiar species of mammiferous herbivorous animal, and selects, with wonderful instinct, as the spot in which to deposit its eggs, that portion of the body of the

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Ditto, An Essay on the Bots of Horses and other Animals, 4to. 1815.—Ditto, on the Insects called Oistros by the Ancients, in ditto, tom. xv. 1827.

MacLeay, on the Insect called Oistros by the ancient Greeks, and Asilos by the Romans, in ditto, tom. xiv. 1824.—Ditto, on the Œstrus of Mr. Bracy Clark, in Zool. Journ. tom. i. and v.

Keferstein. Remarques sur l'Oistros des Anciens. Isis, 1827.

Leach, on the Arrangement of the Œstrideous Insects, in Wernerian Trans. 1817.

Isidore Geoffroy Saint Hilaire. Report on Trois Notices rélatives à l'Existence de l'Œstre chez l'Homme, in Ann. Soc. Ent. de France, tom. ii. 1833.

Metaxa. Hist. de deux Larves d'Œstres extraites de l'Oreille d'un Paysan, in Mém. de Zool. Médicale. 8vo. Rome, 1835.

———? Vom Œstrus, &c. On the Œstrus which attacks Man in Peru (in Neuen Nord. Beytr. band 1.).

Schrœder. Organ. interne de la Larve de l'Œstre de Cheval, in Ferussac Bull. 1831. No. 1.

Numan. Ueber die Bremsen Larven, im Magen der Pferde. 8vo. 2 pl. Berlin, 1837.

And the general works of *Meigen, Curtis, Wiedemann, Macquart, Fabricius, &c.*

animal which is best adapted for the welfare of its progeny, that is, in places either where the larvæ, when hatched, may burrow into the back, or other part of the body, or where the larvæ may be removed by the tongue of the animal itself into its mouth, and thence to the stomach; in which, exposed to a temperature of more than 100 degrees of Fahrenheit, they remain until full grown, when in either case they quit the body, and making their way to the earth, undergo their transformations under ground. The ox, horse, ass, reindeer, stag, antelope, camel, sheep, hare, and rhinoceros *, are the only quadrupeds hitherto observed to be subject to the attacks of these insects, which appear to instil, as their name implies, a surprising degree of dread † amongst these animals whenever they make their appearance. The larvæ exhibit three principal variations in their habits, being either cutaneous, when the grubs (commonly called Wornils, Wormals, or Worbles) reside in tumours beneath the skin of the animal attacked; cervical, when the grubs burrow into the maxillary and frontal sinuses through the nostrils; or gastric, when the grubs, called in this case bots, are introduced into the stomach. It would seem, however, that these insects occasionally extend their attacks even to man; Humboldt having observed some of the South American Indians whose abdomen was covered with small tumours, produced, as was supposed, by the larvæ of some Œstrus. Moreover larvæ, apparently belonging to this family, have been extracted from the maxillary and frontal sinuses of the human body. (Latreille, *R. An.* v. 502.)

For further notices upon the occurrence of larvæ of this family in the human body, I must refer to a Memoir by Say, in the *Transactions of the Acad. of Natural Scienc. Philadelph.* vol. ii., and *Bull. Scienc. Nat.*, 1823, part 8., in which is contained the description of a

* An Œstrideous larva, obtained from the body of a rhinoceros, is contained in the Museum of the College of Surgeons. The imago is not known. Can it be the Zimb? M. Rob. Desvoidy has communicated to the Academie des Sciences a notice of the occurrence of one of these insects in a badger (*Comptes Rendus*, 1836, No. 2.); and M. Vallot, their existence in the bodies of monkies. (See the memoir of M. Saint Hilaire, noticed above.) M. V. Audouin has shown me the larva of an Œstrus which infests Antilope redunca, which is remarkable for having some of the central segments of the body furnished with very large fleshy tubercles; likewise the larva of another exotic species, which, instead of the ordinary double row of reflexed points, is entirely covered with minute horny acute tubercles, the sides of which, when magnified, are found to be serrated.

† See p. 540. *antè*, for a notice of the controversy between Messrs. B. Clark and MacLeay, relative to the οἶστρος of the ancients.

larva not exactly agreeing with any of the known species of Œstrideous larvæ, and which Dr. Brick had himself extracted from a tumour in his thigh. Mr. E. Doubleday, whose recent Entomological tour in America has added such stores of novelties to our museums, has informed me that he suffered from the presence of a larva in the calf of one of his legs, which unfortunately he destroyed. M. Goudot, the Entomologist, whilst travelling in America, was also similarly attacked. Mr. Howship has also described two cases observed in South America, in one of which the larva was found in the back, and in the other in the scrotum.* He has also published a figure of one of these larvæ. A similar case to the last has also been recorded by M. Roulin, and M. Guérin has also communicated another case from Martinique to the Académie des Sciences, upon which M. I. G. Saint Hilaire has published a report in the *Ann. Soc. Ent. de France*, 1833, p. 518., and see also a notice by M. V. Audouin of an additional case in the same volume, App. p. 65. Likewise the *Mag. of Nat. Hist*, No. 27., and Arture's *Mémoire sur l'Espèce de Ver nommé Macaque.*

The larvæ of the Œstridæ are, in general, thick fleshy grubs, somewhat attenuated towards the head, not furnished with legs. Their body is composed of 11 segments, exclusive of the head; furnished with minute tubercles and spines, the latter often arranged in rows, which facilitate their progression, and are the cause of great irritation to the animals upon which they are parasitic. The chief respiratory organs are placed upon a scaly plate at the posterior extremity of the body, which is thicker than the anterior. It would seem that the mouth of the cutaneous larvæ is composed only of fleshy tubercles, whilst that of the cervical and gastric species is always furnished with two strong unguiform appendages. How far these larvæ (which subsist on the purulent humours secreted by the animals on which they are parasitic, and originating in the irritation produced by their presence) are really detrimental to the animals on which they are parasitic, is a matter of controversy. Mr. B. Clark, whose long experience in veterinary matters gives great weight to his opinion, maintains that they are rather beneficial than otherwise; a contrary opinion has been maintained by Mr. Sells, in a memoir on these insects presented to the Entomological Society, as well as by some other authors. (See Kollar, *Obnox. Ins. Translat.*) The pupa state is passed under ground, the

* "Some account of two cases of inflammatory tumour produced by Œstrus humanus."

skin of the grub becoming a cocoon for the inclosed nymph, as in the other insects undergoing a coarctate transition.

The horse bot-fly deposits its eggs on the hairs of those parts of the horse, which can be easily reached by the tongue of the animal, by which means the larvæ are conveyed into the stomach. The larvæ of this species (*fig.* 132. 19.) are very strongly armed with short thick spines, directed backwards*, and arranged in double transverse rows at the base of each segment of the body; the head is very small; its upper part is produced into two tubercles, which may possibly be ocelli; the maxillæ, judging them to be such from their situation, are a pair of very strong hooks, bent outwards; rather above and between the base of these organs is a pair of much smaller slender corneous organs, which must be the mandibles, and which do not appear to have been previously noticed (*fig.* 102. 20. head of the larva of G. Equi) in this larva. The spiracles are numerous, placed at the posterior part of the body, but defended by the folds of the terminal segment.

Mr. Newport has given a highly magnified figure of the head of the larva of Œstrus Ovis, which lives in the frontal sinus of the sheep (art. *Insect* in *Cycl. of Anat.* p. 23.), in which the front of the head is similarly produced, but each side is furnished with two minute ocelli; towards the front of the head are the horny mandibles?, much longer than in Œ. Equi, hook-like, and directed backwards, whilst the maxillæ? are still smaller hooks, directed inwards. This larva is destitute of the recurved spines; it is furnished with two spiracles at the extremity of the body, which are defended from injury in the same manner as in the horse bot.

In the larvæ of Œstrus Bovis, which reside in the large open tumours of the backs of horned cattle, we find a double modification of structure, admirably in accordance with their habits. Residing immovably in a fixed spot, they do not require the strong mouth-hooks which the horse-bot employs to retain it in its station in the stomach, where it is of course subject to a variety of action; the parts of their mouths are therefore soft and fleshy; on the other hand, the extremity of the body being exposed at the orifice of the tumour, it is in this part of the insect that the two large principal spiracles are found. When full grown, they push themselves backwards out of the tumours, and

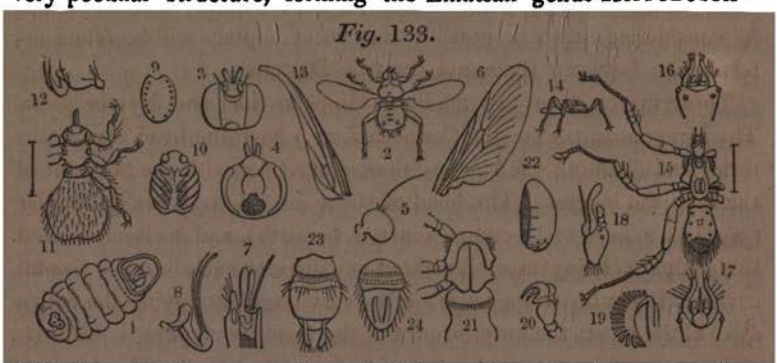
* We have seen in many instances that spines of this kind are employed in progression; hence their importance in enabling the larva to make its way out of the stomach of the horse to the earth, when full grown.

fall to the ground, in which they undergo their changes; the front of the larva skin forming a kind of flat cap, on scaling off which the head of the real pupa is seen (*fig.* 133. 1.).

These variations in the larvæ of these three species render the establishment of at least three genera requisite for the British species. In the very admirable memoir of Fischer ample details are given of the larvæ of the Œ. Bovis and Ovis.

The second general section of the order Diptera, or those forming the fifth stirps, is composed of a small group of parasitic insects of very peculiar structure, forming the Linnæan genus HIPPOBOSCA*

Fig. 133.



(*fig.* 133. 2. Hipp. equina); and differing from the flies composing the former section, in the structure of the mouth, the immersion of the antennæ within the head, and of the latter within the front of the thorax; the denticulation of the tarsal claws, and the nature of their transformations.

These differences, with others of minor importance, induced Latreille to form these insects into a primary section, which he at first named Coleostoma (*Hist. Nat.*, t. ii. 365.), and afterwards Eproboscidea. This name Dr. Leach, who considered these differences suf-

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Nitzsch. Die Fam. und Gatt. d. Thierinsekten, in Germar's Mag. d. Ent. vol. iii.

Modeer, in Gotheborgska Handlung. Vetenskap. St. 3. p. 26.

Dufour. Rech. Anat. sur l'Hippobosca equina, in Ann. Sci. Nat. tom. vi. — Ditto, Décsr. n. s. Ornithomyia in ditto. tom. x.

ficiently strong to warrant the establishment of the insects into a distinct order, changed to Omaloptera, which MacLeay, with more precision, altered to Homaloptera, regarding it however merely as an osculant group. In the more recent works of Latreille, they are still recorded as a primary section of the order Diptera, under the name of PUPIPARA (suggested by Réaumur's name of Nymphipares). Although Dr. Leach has been followed by several English Entomologists, it will be seen that Messrs. Kirby and Spence introduced the Pupipara amongst the Diptera; and, indeed, when we consider the modifications to which the true Diptera are subject in every material character — mouth antennæ, transformations — we are fully warranted in retaining these insects in the order Diptera, as well as in considering it to be possible that other Diptera will be found intermediate between them and the true Diptera.

These insects form two families, Hippoboscidæ and Nycteribiidæ. The HIPPOBOSCIDÆ (or the Coriacea *Latr.*) have the head always anterior and distinct; the legs are short and robust, with the 5th joint of the tarsi the longest. The head of these insects is generally circular (*fig.* 133. 3. head of H. equina above, 4. beneath), and is closely united to the thorax, being inserted without any distinct neck into the frontal cavity of the latter; the eyes are often very large, occupying the entire sides of the head; the anterior part of the head, or clypeus, is distinct, and separated by a curved impression from the latter. This clypeus is of a reversed heartshaped form, having the antennæ immersed in the anterior angles; these organs, when extracted, are either of a rounded shape, having several bristles arising from their external part (*fig.* 133. 5. ant. of H. equina), or plate like and bristly. Many erroneous views have been entertained respecting the structure of the mouth; and the opinions of authors, upon the affinities of these insects, have thence been very unsettled. It is only very recently that the true formation has been shown by Curtis, Latreille, Newport, Dugés, and in the posthumous work of Lyonnett, whose views I have confirmed by dissection, whereby I am enabled to add a few observations to what has been previously recorded. The anterior portion of the under surface of the head in Hippobosca is covered with a membranous plate, which, at its apex, is furnished with a small central orifice, and at the sides with a pair of coriaceous plates, narrow, elongated, and bristly, extending beyond the front of the head, and forming, when in inaction, a kind of rostrum, as in *fig.* 133. 11.

In the inner part of the head, between the roots of the antennæ, arises an elongated fleshy lobe, which, when in action, is folded back, extending quite to the hinder extremity of the cavity of the head, and capable of protrusion, having at its extremity, but placed so as to point forwards, a long curved, horny, slender, and nearly tubular seta, channeled along its upper edge, and dilated at its base, receiving in its upper channel two other setæ* of unequal thickness, but of equal length (*fig.* 133. 8.). The apex of these three setæ passes through the minute orifice above mentioned (*fig.* 133. 7.), and when at rest is to be observed sheathed between the two coriaceous valve-like plates; but when in action the internal lobe is pushed forward, and the setæ are conjointly porrected (passing through the minute orifice like a thread through the eye of a needle), their basal portion extending as far as the base of the rostriform plates. It is exceedingly difficult to trace the analogies presented by these various organs.†

The three internal setæ being of unequal size, and consequently single organs, cannot represent either mandibles or maxillæ, and must therefore be regarded as the analogies of the labrum, lingua, and labium; the mentum must therefore be the base of the latter, and cannot be regarded as represented by the membranous plate covering the front of the underside of the head, as described by Mr. Curtis. What then are the two rostriform plates? these being double must represent either mandibles, maxillæ (as doubtingly described by Curtis, Dugés, and Newport), maxillary palpi, as supposed by Latreille, or labial palpi or labial lobes, as regarded by Dufour. The two latter analogies would be negatived by the existence of a distinct and separate internal labium. They can scarcely be maxillary palpi, because the maxillæ are not developed, whilst their situation, arising from the underside of the head, seems to imply, regard being had to the other parts of the mouth, that they cannot represent either mandibles ‡ or maxillæ. Moreover there are only a single pair of these

* Latreille states this instrument to be composed of two setæ, and Dugés of four. I have only found it to consist of three, as has also Curtis.

† Dugés (in his *Memoir on Pulex*), Curtis, Newport (art. *Insect*, in *Cycl. Anatomy*), and Percheron (*Gen. des Ins. Dipt.* pl. 6.) have attempted to trace these analogies, and have arrived at various conclusions.

‡ That they are not mandibles, seems to result from the non-development of maxillæ, the latter existing in all Diptera which possess the former. Latreille has observed that "dans les Melophages la base des lames du suçoir est recouverte par deux petites pièces coriaces, triangulaires, réunies, et formant une sorte de labre. Elles semblent representer, en petit, les deux pièces qui recouvrent la base de la

organs, and I recollect no instance in the Diptera in which mandibles exist without maxillæ, or maxillæ without maxillary palpi. If we look at the usages of these organs, a very material variation must exist in the manner of taking the food; the rostriform plates must perform the office of the palpi in the other Dipterous families, to clear away the hair or feathers from the spot in which the long setæ are to be thrust; the largest of which setæ forms a canal for the ascent of the nutritive fluids into the pharynx. In the other Diptera, this is effected by the assistance of the large fleshy labial lobes, acting as suckers to draw these fluids to the surface of the skin; but here these are wanting, and consequently there can be no suction; but this is easily accounted for, from the great length of the internal setæ, which must penetrate far deeper than those of the other Diptera, excepting those of the Gnat, in which, owing to this peculiarity, the labial lobes are very slightly developed.

These insects are of small size, and much clothed with bristles, and have been termed by French authors, Spider-flies; they reside upon quadrupeds and birds, running with great agility, and often sideways, and burying themselves amongst the hair or feathers. The body is short and depressed, covered with a tough leathery skin. Latreille lays it down as a rule, that the Pupipara are destitute of ocelli, but this is not the case; none exist in Hippobosca; in Craterina they are very obscure, and sunk in 3 minute foveolæ, but in Ornithomyia they are quite distinct, as Dufour observed: the thorax is dilated behind, having 2 spiracles on each side; Latreille has discovered the posterior pair in the forest fly (Hippobosca), which Dufour had overlooked, situated near the base of the balancers. Curtis also observed 4 in Stenepteryx. Latreille described 10 spiracles in the abdomen of the sheep tick (Melophagus), but Lyonnett, with still greater precision, discovered two pairs of thoracic, and seven pairs of abdominal spiracles in the last named insect. The wings, when present, are either incumbent, or divaricate, and are always accompanied by balancers; the apical nervures of the former in some species are very indistinct, (*fig.* 133. 6. wing of Hipp. equina; 13. wing of Stenepteryx Hirun-

trompe de la puce," (*R. An.* tom. v. p. 539.); that is, the maxillæ, in which view of the subject the large lateral lobes of the mouth in these insects would necessarily represent maxillary palpi. Mr. Curtis has figured these "petites pièces," in *Ornithomyia*, as anterior lobes of the mentum, and Mr. Newport, in *Oxypterum*, as undeveloped mandibles.

dinis). In others, the wings and balancers are entirely wanting, the legs are short and strong, and terminated by very powerful denticulated claws (*fig.* 133. 12.).

The abdomen is covered with a continuous membrane, capable of great distension, which occurs in the females, the larvæ hatching and being nourished in that situation until they have assumed the pupa state, when each is deposited in the shape of a soft white roundish egg notched at one end, without any trace of articulation, and nearly as large as the abdomen of the parent fly (*fig.* 133. 9.). Subsequently this puparium becomes hard, and dark coloured, and within this puparium the real pupa (*fig.* 133. 10.) is found, and from which the fly escapes by scaling off the notched extremity of the case. Although these insects are furnished with a pair of remarkable ovaries, their progeny consists but of a single pupa, after the exclusion of which the abdomen becomes shrivelled and contracted.

Mr. MacLeay considers that the Pupipara effect the passage between the classes of Haustellata and Arachnida. Mr. Curtis, however, in his observations, has endeavoured to show that a more natural transition is effected between the Mandibulata and Arachnida, by means of the voracious Cicindelidæ and the spiders. The instances which he has adduced in support of this view, appear to me to be remote analogies, whilst, on the other hand, the connexion between the Hippoboscidæ and Nycteribiidæ, and certain Arachnida is so strong as to become almost an affinity. The latter, it is true, are not the typical Arachnida, or Spiders, as might be imagined from the vernacular French name given to these insects, expressive of their resemblance to spiders — "mouches araignées," but to others which have not hitherto been regarded as affording so strong a relationship, namely, the Acarideous Arachnida or Ticks. This relationship is so strong, as regards habits and economy, that there is no wonder that one of the Hippoboscidæ should be called the Sheep-tick. Whilst, if we look at the construction of the mouth, we have precisely the same number of organs, the external pair of which are exactly similar to the rostriform plates of the Hippoboscidæ. (*Vide* M. Audouin's admirable paper, in the *Ann. Sc. Nat.* tom. xxv. pl. 14.)

These insects vary greatly in the animals they inhabit. The species of Ornithomyia, Stenepteryx (remarkable for the narrowness of its wings), and Oxypterum are parasitic upon various kinds of birds (see Curtis); those of Hippobosca upon quadrupeds, especially the

horse, as well as occasionally upon oxen; Lipoptena Cervi * *Nitzsch* (Ped. Cervi *Panzer Ins. Germ.* 51. 15.), upon the stag; Melophagus ovinus (*fig.* 133. 11.) upon the sheep. Lipoptena Phyllostomatis *Nitzsch* (*Voyage of Prince Maximilian of Bavaria*; and Perty, *Del. An. art. Bras.* pl. 37. *fig.* 16.), infests a Brazilian species of bat. The genus Strebla, of which I possess several species, are likewise parasitic upon the same tribe of animals, as are also all the Nycteribiæ. Nitzsch also describes a minute insect which is parasitic upon the honey bee, as a "genus Epizoïcum Dipteris affine," under the name of Braula cæca, in which the head is vertical, broad, triangular, with antennæ apparently resembling those of Stenepteryx, each being formed of two lobes; the eyes and ocelli are wanting, the thorax short, bipartite, apterous; the abdomen continuous, with the latter broader and oval; legs six, short with 5-jointed tarsi. It is figured by Ahrens in his Fauna, fasc. 6. Nitzsch only notices that of four hive bees given to him by Keferstein, each was infested with a single Braula, but M. Stern, whose observations are given by Kollar, observed as many as eleven on a single queen bee. (*Treatise on Obnox. Ins. Transl.* p. 74.) Authors have overlooked the figures given of this insect by Réaumur (*Mém.* tom. v. pl. 38. *fig.* 1—4.).

Various remedies are suggested by Kollar against the attacks of such of these insects as infest domesticated animals or birds. (*Treatise on Obnox. Ins. Transl.*) See Réaumur (*Mém.* vol. vi. 14th Mém. pl. 48.) *Hipp. Equina*, tom. iv. 3d Mém. pl. 11. (Stenepteryx Hirundinis); — De Geer (*Mém.* vol. vi. tab. 16. Hippob. equina and Ornithomyia avicularia); — Lyonnett, *Posth. Researches*, pl. 1, 2, 3. (Melophagus ovinus); — Dufour, in the memoirs above referred to; — and Curtis (*Brit. Ent.* pl. 14. 122. 142. 421. 585.), for further details of these insects.

The second family of the stirps Pupipara (NYCTERIBIIDÆ †)

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* This species possesses very short rudiments of wings and halteres. In Melophagus ovinus (*fig.* 133. 11.) both the wings and halteres are wanting, being the only instance I am acquainted with, except in the species of Molobrus noticed by Mr. Haliday under the name of Chionea venatica, in which halteres are wanting. (See Generic Synopsis; Molobrus.)

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† BIBLIOGR. REFER. TO THE NYCTERIBIIDÆ.

Montague, in Trans. Linn. Soc. London, t. 11. 1813. (Nycteribia).

Phthiromyia *Latr.*), composed of the single genus Nycteribia (*fig.* 133. 14. 15., N. Sykesii *Westw.*), has the head very small and dorsal, not being received into a deep anterior excavation of the prothorax (*fig.* 133. 16. head above, 17. beneath, 18. sideways). The antennæ are very short and biarticulate. The mouth consists of two large lateral setose valves, and a central style, which I found to enclose several setæ, thus perfectly analogous to the mouth of the Hippoboscidæ. They have neither wings * nor balancers, but the intermediate legs are connected at the base with a pair of strong comb-like organs, (*fig.* 133. 19.), which are the probable representatives of the wings. The thorax is flat, and singularly constructed, and the first abdominal segment is very short, and on its ventral surface armed with a row of strong short bristles (*fig.* 133. 21. under side of thorax, and base of abdomen). The legs are very long, with the basal joint of the tarsi exceedingly long and articulated, and the terminal ungues very strong and hooked (*fig.* 133. 20.). The under side of the extremity of the abdomen of the male is furnished with two elongated slender incurved appendages (*fig.* 133. 24. N. biarticulata ♂); that of the female is destitute of exserted organs, except in the last named species, in which there are two elongated, clavate, and setose styles (*fig.* 133. 23.). The only species hitherto discovered live upon the bodies of bats, and compose the genus Nycteribia *Latr.*, Phthiridium, *Hermann.* In my memoir on this genus, I described the puparium (*fig.* 133. 22.), which I had succeeded in extracting from the abdomen of a large Indian species (N. Sykesii *Westw.*), thus further proving its relation to Hippobosca.

I think this the fittest place to notice some anomalous insects of minute size communicated to me by J. Hogg, Esq., F.L.S., discovered by him inhabiting Spongilla fluviatilis, and respecting whose natural relations, and even the order to which they belong, I am in doubt.

Dufour, in Ann. Sci. Nat. April, 1831 (Nycteribia).
Guérin. Icon. R. An. Ins. (Nyct. Westwoodii).
Hardwicke, Gen. Drawings of Indian Ins. in Brit. Museum.
Westwood, in Trans. Zool. Soc. vol. i. (Monogr. Nycteribia).

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* Such at least is the case with all the hitherto described species. Mr. Mac Leay has, however, shown me a species from the West Indies possessing short wings.

They are scarcely more than one-eighth of an inch in length, and have six moderately long slender legs. They have at first sight the appearance of Aphides, being apterous, with two long slender antennæ, and the mouth consists of four naked setæ, equalling the antennæ in length, and porrected; they arise in pairs, and are not enclosed in any sheath nor are they palpigerous. The body is clothed with numerous long hairs, and each of the abdominal segments is furnished at the sides with a pair of long flattened articulated filaments, somewhat like those of the larva of Sialis lutaria, which are evidently organs of respiration, and kept in constant agitation in their watery abode. I know no insects of which these animals can be considered as the larvæ*; whilst as they possess certain points of resemblance with the permanently apterous Coccidæ and Aphidæ, it is not impossible that they may have arrived at the imago state. I must refer for further details to the description and figures which I have presented to the Entomological Society of London.

* Can they be the larvæ of the anomalous genus Acentropus?

THE END.

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SYNOPSIS

OF THE

GENERA OF BRITISH INSECTS.

CLASS. HEXAPOD METAMORPHOTIC INSECTS.

Subclass I. *Mouth with Jaws.*

ORDER I. COLEOPTERA *Aristotle.* (ELEUTHERATA *Fabr.*, ELYTROPTERA *Clairv.*)

Sect. I. PENTAMERA *Latreille.*

Tribe 1. *Chilopodomorpha* MacLeay.

Subtribe 1. *Adephaga* Clairv.

Stirps 1. *Geodephaga* MacLeay.

Family 1. *CICINDELIDÆ* Kirby. (Cicindela *Linn.*)

CICINDELA *Linn, &c.* BUPRESTIS p. *Geoffroy.* 6 sp. *Cic. campestris* Linn. Anterior tarsi ♂ with the three basal joints elongated and dilated; elytra oblong, ovate, depressed; thorax subquadrate. Curt. Brit. Entomol. pl. 1.

Family 2. *CARABIDÆ* Leach. (Carabus *Linn.*)

Subfamily 1. *Brachinides* Westw. (Brachinidæ *MacLeay*, Truncatipennes *Latr.*)

DRYPTA *Fabr.* CARABUS p. *Marsh.* 1 sp. *D. emarginata* Fabr. Curt. 454. Basal joint of antennæ very long; thorax long, cylindric; penultimate joint of tarsi bilobed; palpi with the last joint securiform.

POLYSTICHUS *Bonelli.* GALERITA p. *Fabr.* 1 sp. *P. vittatus* Brullé. Curt. 223. Depressed; head triangular; thorax subcordate; palpi long; tarsi simple; mentum-tooth triangular.

ODACANTHA *Payk.* ATTELABUS p. *Linn.* 1 sp. *Attel. melanurus* Linn. Curt. 227. Thorax long, cylindric; tarsi simple; basal joint of antennæ short; head broader than the thorax.

DEMETRIAS *Bonelli.* RHYZOPHILUS *Leach.* 4 sp. *Carab. atricapillus* Linn. Depressed; thorax cordate; penultimate joint of tarsi bilobed; second joint of antennæ short; claws simple. Curt. 110.

DROMIUS *Bonelli.* DEMETRIAS p. *Panz.* 19 sp. *Carab. 4-maculatus* Linn. Depressed; thorax subcordate; tarsi simple; second joint of antennæ as long as third; last joint of max. palpi truncate. Curt. 231.

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* Throughout this Synopsis, the first line of each genus comprises the following particulars: — 1. Name of the genus; 2. name of its founder; 3. synonyme of the genus; 4. author of the synonymical genus; 5. number of British species; 6. typical species; 7. reference to the best figure; this last item being occasionally, for want of space, placed after the description of the genus.

LEBIA *Latreille.* CARABUS p. *Linn.* 8 sp. *C. crux minor* Linn. Curt. 87.
Depressed, broad; thorax transverse, lobed behind; penultimate joint of tarsi bilobed.

LAMPRIAS *Bonelli.* LEBIA p. *Latr.* 4 sp. *C. cyanocephalus* Linn. Curt. 282.
Depressed, broad; thorax transverse, cordate, lobed behind; labrum quadrate; fourth tarsal joint bilobed.

TARUS *Clairville.* CYMINDIS *Latr.* 7 sp. *C. humeralis* Marsh. Curt. 235.
Depressed; thorax cordate, truncate; claws denticulated; tarsi simple; labial palpi ♂ with the basal joint securiform.

BRACHINUS *Weber.* CARABUS p. *Linn.* 5 sp. *C. crepitans* Linn. Curt. 554.
Oval, convex; thorax narrow; labrum transverse; tarsi simple; palpi filiform; claws simple.

Subfamily 2. Scaritides *Westw.* (Scaritidæ *MacL.* Bipartiti *Latr.*)

SCARITES *Fabr.* TENEBRIO p. *Linn.* 1 sp. *C. Beckwithii* Steph.
Oblong, subdepressed; antennæ elbowed; mandibles with strong teeth. Steph. Ill. Brit. Ent. vol. i. pl. 3.

(OXYGNATHUS *Dej.* ARPEPHORUS *Hope Mss.* 1 sp. *O. anglicanus* Steph.
Oblong depressed; antennæ elbowed; mandibles not toothed. Steph. Ill. 1. pl. 3.)

CLIVINA *Latr.* TENEBRIO p. *Linn.* 2 sp. *T. Fossor* Linn. Curt. 175.
Thorax quadrate; mandibles denticulated; anterior tibiæ palmated.

DYSCHIRIUS *Panz.* CLIVINA p. *Gyll.* 14 sp. *Scarites gibbus* Fabr.
Thorax globose; mandibles denticulated; anterior tibiæ palmated. Curt. 354.

DISTOMUS *Leach.* DITOMUS p. *Dej.* 1 sp. *Dis. Leachii* Steph.
Anterior tibiæ not palmated; head unarmed. Steph. Ill. 1. pl. 3.

Subfamily 3. Harpalides *Westw.* (Harpalidæ *MacL.* Thoracici *Latr.*)

Division 1. Feronidea *Westw.* (Feroniens *Dej.* Simplicimani *Latr.*)

POGONUS *Zeigl.* RAPTOR *Megerle.* 5 sp. *P. Burrellii* Haw. Curt. 47.
Anterior tarsi ♂ with two dilated joints; thorax subquadrate; labrum emarginate.

PATROBUS *Megerle.* BLETHISA p. *Pz.* 2 sp. *Car. rufipes.* Curt. 192.
Anterior tarsi ♂ with two dilated joints; thorax subcordate; labrum straight.

Obs. All the remaining genera have the three basal joints of the male tarsi dilated.

CALATHUS *Bonelli.* CARABUS p. *Linn.* 11 sp. *C. melanocephalus* Linn.
Tarsal claws toothed; thorax subquadrate; palpi simple. Curt. 184.

ODONTONYX *Steph.* CARABUS p. *Marsh.* 1 sp. *C. rotundicollis* M.
Tarsal claws toothed; thorax rounded; wings 0.

SYNUCHUS *Gyll.* TAPHRIA *Bon.* 1 sp. *Car. nivalis* * Pz. Pz. F. I. G. 37. 19.
Tarsal claws toothed; labial palpi with the last joint securiform; thorax rounded; wings, 2.

PRISTONYCHUS *Dej.* LÆMOSTHENES *Bon.* 1 sp. *Car. Terricola,* Pk.
Tarsal claws toothed; thorax subcordate; last joint of labial palpi simple; wings 0. Pz. F. I. G., 30 f. 3.

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* This has generally been written vivalis, but improperly. Vid. Pz. F. I. G. and Ind. Meth. p. 53. and Aud. and Brullé, Hist. des Insectes, vol. iv. p. 307.

Obs. The following genera have the tarsal claws simple : —

SPHODRUS *Clv.* CARABUS p. *Linn.* 1 sp. *Car. leucopthalmus* Linn.
Antennæ with the third joint as long as the two following united. Pz. F. I. G. 9. f. 4.

PLATYNUS *Bon.* ANCHOMENUS p. *Sturm.* 2 sp. *Car. angusticollis* F.
Mentum-tooth entire; thorax cordate; posterior angles acute; elytra depressed; head narrower than the thorax. Pz. F. I. G. 73. f. 9.

ANCHOMENUS *Bon.* CARABUS p. *Fabr.* 4 sp. *Car. prasinus* F. Pz. 16. f. 6.
Mentum-tooth entire; thorax cordate; posterior angles acute; elytra oblong, subconvex; head as broad as the thorax.

AGONUM *Bon.* CARABUS p. *Linn.* 30 sp. *C. 6-punctatus* Linn. Curt. 183.
Anterior tarsi of males with the joints elongated; mentum-tooth simple; thorax rounded.

OLISTHOPUS *Dej.* CARABUS p. *Payk.* 1 sp. *C. rotundatus* Pk.
Thorax rounded; mentum-tooth obsolete; basal joints of tarsi elongated. Steph. Ill. 1. pl. 6.

PLATYDERUS *Steph.* ARGUTOR p. *Dej.* 1 sp. *Car. ruficollis* M.
Thorax broad, subquadrate, depressed; body flat; palpi with the terminal joint ovate, cylindric; truncate at tip.

7 ARGUTOR *Megerle.* PLATYSMA p. *Sturm.* 10 sp. *Car. vernalis* F.
Thorax subcordate, truncate; body depressed, narrow; palpi with the last joint fusiform. Curt. 666.

PŒCILLUS *Bon.* CARABUS p. *Linn.* 7 sp. *C. cupreus* Linn. Curt. 107.
Thorax subquadrate; elytra subconvex; palpi cylindric; mentum-tooth broad, obtuse; colours metallic.

SOGINES *Leach.* PŒCILLUS p. *Dej.* 1 sp. *Car. punctulatus* Ill. Pz. 30. f. 10.
Thorax with an elevated lateral line on each side; head large; body depressed; palpi robust; terminal joint obtusely truncated.

? OMASEUS *Zeigl.* PTEROSTICHUS p. *Sturm.* 13 sp. *Car. aterrimus* F.
Thorax subquadrate; elytra entire, subdepressed; palpi cylindric; antennæ with the second joint nearly as long as the third. Curt. 15.

7 STEROPUS *Megerle.* MOLOPS p. *Sturm.* 4 sp. *Car. madidus* F. Curt. 171.
Thorax suborbicular; elytra entire; oval subconvex; wings 0; mentum-tooth broad, bifid.

7 BROSCUS *Pz.* CEPHALOTES *Bon.* 1 sp. *Car. cephalotes* Linn. Donov. 484.
Thorax very much attenuated behind; body elongate; mentum-tooth obtuse; head large.

MISCODERA *Esch.* { LEIOCHITON *Curt.* / ONCODERUS and SPHÆRODERUS *Steph.* } 1 sp. *Dysch. arcticus* Pk.
Thorax globose; elytra ovate, convex; head small; mentum-tooth obtuse, entire, small. Curt. 346.

STOMIS *Clv.* CARABUS p. *Marsh.* 1 sp. *Car. pumicatus* Ill. Clv. 2. pl. 6. f. A.
Body elongate, narrow, subconvex; thorax cordate; mandibles very long and porrected.

PTEROSTICHUS *Bon.* COPHOSUS p. *Dej.* 6 sp. *Car. fasciato-punctatus* F.
Body depressed; thorax subcordate, truncate; palpi robust; mentum-tooth short, bifid. Pz. 67. f. 9.

COPHOSUS *Zeigl.* PTEROSTICHUS p. *Curt.* 1 sp. *Coph. elongatus* Dej.
Body long, cylindric, parallel; antennæ short; palpi stout; wings 0. Curt. 196.

ADELOSIA *Steph.* PTEROSTICHUS p. *Steph.* 1 sp. *Car. macer* Marsh.
Body very depressed; thorax much narrowed behind; antennæ rather short; palpi very slender. Steph. 1. pl. 7. f. 5.

7 PLATYSMA *Bon.* SIMOTHELUS *Meg.* 1 sp. *Car. niger* Fabr. Oliv. 3. 48 pl. 1.
Thorax subquadrate, narrower than the elytra; elytra subovate, subdepressed; palpi slender; mentum-tooth robust, bifid.

ABAX *Bon.* PTEROSTICHUS p. *Sturm.* 1 sp. *Car. striola* Fabr. Pz. 91. f. 6.
Body depressed; thorax square, as broad as the elytra, which are soldered together, with an elevated humeral carina; colours black.

CHEPORUS *Latr.* ABAX p. *Steph.* 1 sp. *Car. metallicus* Fabr. Pz. 11. f. 7.
Body subdepressed; thorax nearly as broad as the elytra, which are separate, ovate, and subconvex; joints of antennæ short, submoniliform.

OODES *Bon.* CARABUS p. *Fabr.* 1 sp. *Car. helopioides* Fabr. Pz. 30. f. 11.
Body subconvex, elongate, ovate; thorax as broad as the elytra; mentum-tooth entire.

AMARA *Bon.* CARABUS p. *Linn.* 27 sp. *Car. vulgaris* Linn. Pz. 40. 1.
Oblong, ovate, broad, subdepressed; thorax as broad as the elytra; wings two; mentum-tooth bifid; last joint of the palpi ovate.

(ACRODON *Zimm.* AMARA p. *Steph.* 5 sp. *Harp. brunneus* Gyll. Sturm. D. F., 146.)

(CELIA *Zimm.* AMARA p. *Steph.* 2 sp. *Harp. bifrons* Gyll.)

BRADYTUS *Steph.* AMARA p. *Sturm.* 6 sp. *Car. ferrugineus* Linn. Pz. 39. 9.
Body subconvex; mentum-lobe entire; thorax nearly as broad as the elytra, rather narrowed behind, subcordate.

CURTONOTUS *Steph.* LEIRUS *Meg.* 2 sp. *Car. convexiusculus* M.
Body elongate, ovate, subconvex; mentum lobe bifid, intermediate tibiæ ♂ tubercled and spined; third joint of max. palpi long, clavate. Steph. pl. 8. f. 1.

ZABRUS *Clv.* CARABUS *Fabr.* 2 sp. *Car. gibbus* Fabr. Curt. 188.
Body gibbous; elytra very convex; mentum-tooth obtuse.

Division 2. Harpalidea *Westw.* (Harpaliens *Dej.*)
Quadrimani *Latr.*

HARPALUS *Latr.* CARABUS p. *Fabr.* 56 sp. *Car. ruficornis* Fabr. Curt. 458.
Elongate, ovate, subconvex; thorax as broad as the elytra; mentum-tooth obtuse, simple; antennæ with the two basal joints naked.

ANISODACTYLUS *Dej.* HARPALUS p. *Steph.* 4 sp. *Car. binotatus* Fabr.
First tarsal joint ♂ small; the fourth joint largest; mentum tooth obsolete; thorax subquadrate or trapezoid. Pz. 92. f. 3.

PANGUS *Zeigl.* HARPALUS p. *Steph.* 1 sp. *Harp. scaritides* Sturm.
Palpi with the terminal joint subcylindric; thorax narrowed behind; angles rounded; antennæ rather short. Stm. D. F., 91. c.

ACTEPHILUS *Steph.* CARABUS p. *Dufts.* 2 sp. *Car. vernalis* Dufts.
Thorax transverse; posterior angles rounded; anterior legs stout; antennæ short; palpi with the terminal joint longest. Stm. D. F. 90. a.

OPHONUS *Zeigl.* HARPALUS p. *Dej.* 13 sp. *Harp. obscurus* Fabr. Curt. 191.
Body pubescent; thorax punctured, subquadrate; max. palpi with the last joint ovate; mentum transverse, short; mentum-tooth scarcely visible, not bifid.

DIACHROMUS *Erichson.* OPHONUS p. *Steph.* 1 sp. *Car. germanus* Linn.
Thorax punctured; mentum-tooth short, rather obtuse; anterior tarsi ♂ dilated, beneath equally cushioned; the penultimate joint transverse, cordate. Curt. 191.

STENOLOPHUS *Zeigl.* TRECHUS p. *Stm.* 3 sp. *Car. vaporariorum* Linn. Mentum tooth obsolete; palpi truncate at the tips; thorax suborbicular; body destitute of pubescence. Steph. Ill. M. 1. pl. 9. f. 2.

MASOREUS *Zeigl.* BADISTER p. *Creutz.* 1 sp. *M. luxatus* Dej. Curt. 287. Thorax transverse; posterior margin, with a transverse lobe; elytra oblong, depressed; palpi truncate at the tip; antennal joints equal.

TRECHUS *Clv.* ACUPALPUS *Dej.* 13 sp. *Car. meridianus* Linn. Pz. 75. 9. Body ovate, subconvex; palpi with the last joint conic, acute; posterior angles of thorax obtuse.

(BRADYCELLUS *Erichson.* TRECHUS p. *Steph.* M. 5. 384. *Harp. placidus* Gyll.)

BLEMUS *Zeigl.* TRECHUS *Dej.* 5 sp. *Car. discus* Fabr. Curt. 310. Elongate, depressed; palpi with the last joint as long as the third, conic; thorax narrowed behind; angles acute.

EPAPHIUS *Leach.* TRECHUS p. *Dej.* 1 sp. *Car. secalis* Pz. Thorax orbicular, cordate; elytra oval, broad, convex; wings 0; anterior tarsi ♂ with two dilated joints. Stm. D. F. 6. 152. d.

ÆPUS *Lea.* TRECHUS p. *Dej.* 1 sp. *Æp. fulvescens* Lea. Curt. 208. Head large; elytra flattened; mandibles porrected, multidentate; terminal joints of palpi attenuated.

Division 3: Chlæniidea *Westw.* (Chlæniens *Dej.* Patellimani *Latr.*)

LORICERA *Latr.* CARABUS *Fabr.* 1 sp. *Car. pilicornis* Fabr. Donov. 367. Antennæ with the third and three following joints emitting long bristles; thorax suborbicular.

PANAGÆUS *Latr.* CARABUS p. *Linn.* 2 sp. *Car. crux major* Linn. Thorax orbicular, convex; palpi with the last joint securiform; mentum tooth bifid. Steph. Ill. 1. pl. 4. f. 6.

BADISTER *Clv.* AMBLYCHUS *Gyll.* 5 sp. *Car. bipustulatus* Fabr. Curt. 139. Body subdepressed; palpi with the last joint elongate, ovate; labrum deeply notched; mentum tooth obsolete.

TRIMORPHUS *Steph.* BADISTER p. *Sturm.* 2 sp. *T. scapularis* Steph. Mandibles obtuse; labial palpi with the last joint oval; max. palpi with the last joint longer than the third; thorax cordate. Steph. Ill. 1. pl. 9. f. 5.

LICINUS *Latr.* CARABUS p. *Fabr.* 3 sp. *Car. cassideus*, Fabr. Curt. 75. Mandibles very obtuse; mentum tooth obsolete; palpi with the last joint large, securiform.

(DIPLOCHEILUS *Brullé.* REMBUS *Steph.* 1 sp. *Car. impressus* Fabr. Palpi with the last joint subovate; thorax subcordate; elytra elongate; tarsi ♂ with three dilated joints.)

EPOMIS *Bon.* CHLÆNIUS p. *Sturm.* 1 sp. *E. circumscriptus* Dej. Palpi with the last joint elongate, securiform; mentum-tooth distinct, bifid; thorax truncate, cordate. Steph. 1. pl. 5. f. 3.

CHLÆNIUS *Bon.* CARABUS p. *Linn.* 7 sp. *Car. marginatus* Linn. Curt. 83. Palpi with the last joint ovate, truncate; mentum-tooth bifid; thorax truncate, subcordate, or broadest behind.

CALLISTUS *Bon.* CARABUS p. *Fabr.* 1 sp. *Car. lunatus* F. Curt. 180. Outer lobe of maxillæ exarticulate; mentum-tooth obtuse; thorax cordate, truncate, convex.

Subfamily 4. *Carabides* Westw. (Carabidæ *MacLeay.*, Grandipalpi, Abdominales *Latr.*)

Division 1. Carabidea *Westw.* (Carabidæ *Steph.*)

CYCHRUS *Fabr.* Tenebrio p. *Linn.* 1 sp. *T. rostratus* Linn. Curt. 426.
Head long, narrow; palpi with the last joint large and spoon-shaped; mandibles long; tridentate at the tip; wings 0.

PROCRUSTES *Bon.* Carabus p. *Linn.* 1 sp. *C. coriaceus* Linn.
Labrum trilobed; mentum-tooth bifid; thorax subquadrate. Stm. D. F. 3. pl. 54.

CARABUS *Linn.* Tachypus *Weber.* 17 sp. *C. violaceus* Linn. Curt. 446.
Labrum bilobed; mentum-tooth entire; thorax subcordate; wings 0 or rudimental; palpi with the last joint securiform.

CALOSOMA *Weber.* Carabus p. *Linn.* 2 sp. *Car. sycophanta* L. Curt. 330.
Labrum bilobed; thorax suborbicular; abdomen subquadrate; wings large; palpi with the last joint ovate, truncate.

LEISTUS *Frolich.* Pogonophorus *Latr.* 8 sp. *Car. spinibarbis* Fabr.
Maxillæ with the base externally armed with long spines; mandibles dilated at the base, externally; palpi elongated. Curt. 176.

Division 2. Elaphridea *Westw.* (Elaphridæ *Steph.*)

NEBRIA *Latr.* Carabus p. *Linn.* 8 sp. *Car. complanatus* L. Curt. pl. 6.
Depressed; labrum subquadrate, slightly emarginate; palpi with the last joint slightly dilated, obliquely truncate; wings two.

HELOBIA *Leach.* Nebria p. *Latr.* 6 sp. *Car. brevicollis* Fabr. Curt. 103.
Depressed; thorax transverse, cordate; wings two; labrum transverse.

ALPHÆUS *Bon.* Nebria p. *Dej.* 1 sp. *A. castaneus* Bon.
Subdepressed; thorax cordate; wings 0; palpi with the last joints rounded.

PELOPHILA *Mann.* Blethisa p. *Bon.* 1 sp. *Car. borealis* Pk. Curt. 302.
Antennæ short; labrum transverse, subemarginate; thorax cordate, truncate.

BLETHISA *Bon.* Carabus p. *Linn.* 1 sp. *Car. multipunctatus* L. Curt. 326.
Antennæ short; labrum subtrilobate; thorax quadrate; palpi rather short.

ELAPHRUS *Fabr.* Cicindela p. *Linn.* 5 sp. *Cic. riparia* Linn. Curt. 179.
Antennæ short; eyes very prominent; thorax convex; labrum slightly trilobed; palpi slender.

NOTIOPHILUS *Dum.* Elaphrus p. *Fabr.* 18 sp. *Cic. aquatica* Linn.
Head as broad as the thorax; eyes large; thorax quadrate, flattened; labrum large, rounded; palpi robust. Curt. 190.

Subfamily 5. *Bembidiides* Westw. (Subulipalpi *Latr.*)

LYMNÆUM *Steph.* Carabus p. *Marsh.* 1 sp. *Car. nigropiceus* M.
Linear, depressed; third and fourth joints of the antennæ equal; fourth tarsal joint with a spine. Steph. 2. pl. 10. f. 1.

CILLENUM *Leach.* Blemus p. *Dej.* 1 sp. *Cill. laterale* Lea. Curt. 200.
Linear, depressed; third antennal joint longer than the fourth; fourth tarsal joint simple; labrum subemarginate.

TACHYS *Zeigl.* Bembidium *Sturm.* 8 sp. *B. obtusum* Stm. Stm. D. F. pl. 161. f. C.
Ovate, subconvex; thorax transverse; hinder angles rounded, entire.

PHILOCTHUS *Steph.* Leia *Meg.* 6 sp. *Bemb. 2-guttatum* Stm. Stm. 161. B.
Ovate, subconvex; thorax transverse; hinder angles rounded and deeply notched

OCYS *K.* Carabus p. *Pz.* *Car. tempestivus* Pz. Steph. Ill. 2. pl. 10. f. 2.
Ovate, subconvex; thorax transverse; hinder angles prominent, acute.

PERYPHUS *Meg.* ELAPHRUS p. *Dufts.* 21 sp. *Car. littoralis* Oliv. Pz. 35. 6.
Thorax truncate, cordate; hinder angles very acute; fifth antennal joint shorter than the third and fourth.

NOTAPHUS *Megerle.* BEMBIDIUM p. *Stm.* 9 sp. *Car. ustulatus* Linn. Pz. 40. 7.
Thorax truncate, cordate; hinder angles acute; third and fourth antennal joints shorter than the fifth.

LOPHA *Meg.* CICINDELA p. *Linn.* 14 sp. *Cic. 4-maculata* L. Pz. 38. f. 8.
Thorax truncate, cordate, gibbose; hinder angles deflexed; eyes moderate.

TACHYPUS *Meg.* LEIA p. *Dej.* 9 sp. *Car. Andreæ* Fabr. Steph. Ill. pl. 10. f. 6.
Thorax truncate, cordate, depressed, sessile; hinder angles deflexed; eyes moderate.

BEMBIDIUM *Illig.* CICINDELA p. *Linn.* 4 sp. *Cic. flavipes* Linn. Pz. 20. f. 2.
Thorax truncate, cordate; eyes extremely prominent; elytra tubercled.

Stirps 2. *Hydradephaga Mac L.* (Hydrocanthari *Latr.*)

Family 1. *DYTICIDÆ* Leach. (Dytiscus *Linn.* Dyticus *Geoff.*)

Subfamily 1. *Haliplides* Westw.

Antennæ 10-jointed; posterior coxæ dilated into a large shield covering the base of the legs.

HALIPLUS *Clairv.* CNEMIDOTUS *Ill.* 11 sp. *Dyt. elevatus* Fabr.
Max. palpi with the last joint very minute and subulate. Pz. F. I. G. 14. f. 9.

CNEMIDOTUS *Erichson.* HALIPLUS p. *Steph.* 1 sp. *Dyt. cæsus* * Duftsch.
Maxillary palpi with the last joint larger than the preceding, conical.

Subfamily 2. *Dyticides.*

Antennæ 11-jointed; palpi filiform, or but slightly thickened; base of posterior legs not covered by the coxæ.

NOTERUS *Clairv.* HALIPLUS p. *Sch.* 2 sp. *Dyt. crassicornis* Fabr. Curt. 236.
Antennæ fusiform; scutellum inconspicuous; posterior tarsal claws equal.

LACCOPHILUS *Leach.* DYTISCUS p. *Linn.* 2 sp. *Dyt. minutus* Linn.
Antennæ setaceous; scutellum inconspicuous; posterior tarsal claws unequal. Pz. F. I. G. 26. f. 3.

HYDROPORUS *Clairv.* HYPHIDRUS p. *Illig.* 50 sp. *Dyt.* 12-*pustulatus* Fab.
Body depressed; anterior tarsi 4-jointed; posterior tarsi slender with equal moveable claws. Curt. 343.

HYGROTUS *Steph.* HYDROPHORUS p. *Clairv.* 11 sp. *Hyp. decoratus* Gyll.
Body subglobose; anterior tarsi 4-jointed; posterior tarsi didactyle. Curt. 531.

HYPHIDRUS *Illig.* HYDRACHNA p. *Fabr.* 2 sp. *Dyt. ovatus* Linn.
Body globose; anterior tarsi 4-jointed; posterior tarsi compressed, with one moveable claw. Donov. 2. pl. 68.

PÆLOBIUS *Schonh.* HYGROBIA *Clairv.* 1 sp. *Dyt. Hermanni* Fabr.
Body subglobose; scutellum distinct; legs gressorial; claws didactyle. Donov. 14. 501.

COLYMBETES† *Clairv.* DYTICUS p. *Linn. &c.* 40 sp. *Dyt. fuscus* Linn.
Scutellum distinct; legs natatorial; labial palpi with the second joint longer than the third; anterior male tarsi slightly dilated; claws of tarsi unequal. Curt. 207.

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* Stephens gives this as synonymous with the impressus *Fabr.*, but the two are considered by Erichson as belonging to different genera.

† This genus has been subdivided into numerous subgeneric groups by Eschscholtz

ILYBIUS *Ericks.* COLYMBETES p. *Steph.* 6 sp. *Dyt. fenestratus* Fab.
Labial palpi with the second and third joints subequal; claws subequal; scutellum distinct; anterior male tarsi slightly dilated. Panz. F. I. G. 38. 16.

AGABUS *Leach.* AGABUS p. *Erich.* 1 sp. *Dyt. serricornis* Payk.
Antennæ ♂ with the terminal joints dilated; maxillary palpi with the last joint subulate; anterior male tarsi slightly dilated. Ahrens, F. 5. f. 3.

HYDATICUS *Leach.* DYTICUS p. *Fab.* 4 sp. *Dyt. Hybneri* Fab. Curt. 95.
Antennæ setaceous; anterior ♂ tarsi patellated; female with smooth elytra.
Obs. Hydaticus cinereus *Fab.* is the type of Eschscholtz's subgenus Graphoderus.

ACILIUS *Leach.* DYTICUS p. *Linn.* 2 sp. *Dyt. sulcatus* Linn. Curt. 63.
Anterior ♂ tarsi patellated; claws didactyle; female with furrowed elytra; max. palpi with the second and third joints unequal.

CYBISTER *Curtis.* TROGUS *Leach.* 1 sp. *Dyt. virens* Mull. (*Roeselii* Fab.)
Anterior ♂ tarsi patellated; posterior tibiæ very short; posterior ungues monodactyle. Curt. 151.

DYTICUS *Geoff.* DYTISCUS p. *Linn.* 8 sp. *Dyt. marginalis* Linn. Curt. 99.
Anterior ♂ tarsi patellated; claws didactyle; maxillary palpi with the second and third joints equal.

Family 2. *GYRINIDÆ* Leach. (Gyrinus *Linn.*)

GYRINUS *Geoff.* DYTISCUS *Linn. olim.* 8 sp. *Gyr. natator* Linn. Curt. 79.
Body depressed; elytra glabrous; maxillary internal palpi distinct.

ORECTOCHEILUS *Esch.* POTAMOBIUS *Leach,* MSS. 1 sp. *Gyr. villosus* Ill.
Body subconvex; elytra pubescent; maxillary internal palpi obsolete.

Subtribe 2. *Rypophaga* Stephens.
Stirps 1. *Philhydrida* MacLeay. (Palpicornes and Clavicornes p. *Latr.*)
Family 1. *HETEROCERIDÆ* MacL. (Acanthopoda *Latr.*)

HETEROCERUS *Bosc.* DERMESTES p. *Thunb.* 7 sp. *Het. marginatus* Fab.
Body oval, subdepressed; tibiæ spinose; antennæ with the seven terminal joints forming a serrated club. Curt. 224.

Family 2. *PARNIDÆ* MacL. (Macrodactyla *Latr.*)
Subfamily 1. *Parnides* Westw. (Parnidæ *Steph.*)

PARNUS *Fabr.* DRYOPS *Oliv.* 5 sp. *P. prolifericornis* Fab. Curt. 80.
Thorax with longitudinal fossulæ; legs rather short; antennæ 9-jointed*, with the second joint produced on the inside into a very large lobe, forming a lateral shield, defending the terminal joints.

DRYOPS *Oliv.* ———— 1 sp. *D. Dumerilii* Latr. Aud. and Br. 5. pl. 14.
Thorax without impressed lines; legs elongate; antennæ with the clava pectinate, the teeth being acute.

(in Dejean's *Catal.* 2d edit.), without any characters having been published by the former author. Mr. Stephens (*Illustr.* vol. v. Suppl.) has, however, supplied this deficiency. I have only adopted the two following subgenera described by Erichson and Leach. Eschscholtz's groups are — Cymatopterus (C. fuscus, &c.), Rantus (C. agilis, adspersus), Leiopterus (C. oblongus).

* M. Dufour states that the antennæ are in reality 10-jointed, the two terminal ones not being distinguished by the serrated appearance of the preceding. I have observed the distinction between these two terminal joints very clearly on macerating and slightly compressing the antennæ.

Subfamily 2. *Elmides* Westw. (Limniidæ *Steph.*).

ELMIS *Latreille.* LIMNIUS *Illiger.* 11 sp. *Elm. Maugetii* Latr. Curt. 294.
Antennæ 11-jointed, as long as the thorax, slightly thickened at the tip; body ovate.

STENELMIS *Dufour.* LIMNIUS p. *Steph.* 1 sp. *Elm. parallelipipedus* Illiger.
Antennæ slender; body narrow; last ventral segment subemarginate. Dufour, Ann. Sci. Nat.

GEORYSSUS *Latr.* CATHAMMISTES *Illig.* vol. vi. 1 sp. *Pimelia pygmæa* F.
Subglobose; antennæ 9-jointed, very short; club large, 3-jointed. Steph. Ill. 2. pl. 13.

Family 3. *HELOPHORIDÆ* MacL. (Helophoridea *Leach.*)

HELOPHORUS *Leach.* ELOPHORUS *Fabr.* 9 sp. *Silph. aquatica* Linn.
Thorax transverse; fore legs moderate; last joint of max. palpi ovate; antennæ 9-jointed; last joint short; eyes sessile. Curt. 466.

HYDROCHUS *Germar.* ELOPHORUS p. *Fabr.* 3 sp. *El. elongatus* Fabr.
Thorax quadrate; fore legs long; eyes very prominent; body narrow; last joint of max. palpi robust; last joint of antennæ long. Curt. 359.

ENICOCERUS *Steph.* HYDRÆNA? *Ahr.* 3 sp. *En. viridicæneus* St.
Max. palpi much shorter than the head, with the 5 terminal joints large; labrum large, notched; elytra broad, oval. Curt. 291.

OCHTHEBIUS *Leach.* HYDRÆNA p. *Latr.* 12 sp. *El. pygmæus* Fabr.
Max. palpi not longer than the head, with the last joint short, slender, and pointed; legs short; thorax entire. Curt. 250.

AMPHIBOLUS *Waterh.* ———— 1 sp. *A. atricapillus* Waterh.
Max. palpi shorter than the thorax; terminal joint short; elytra larger than the abdomen.

HYDRÆNA *Kugell.* ELOPHORUS p. *Gyll.* 18 sp. *H. riparia* Kug.
Max. palpi longer than the head and thorax; last joint long, fusiform; labrum notched. Curt. 307.

SPERCHEUS *Fabr.* HYDROPHILUS p. *Marsh.* 1 sp. *Sp. emarginatus* Fab.
Body broad and very convex; antennæ 6-jointed, ovate; max. lobe very long and slender; tarsi 5-jointed, the last joint very long. Curt. 394.

Family 4. *HYDROPHILIDÆ* MacLeay.

LIMNEBIUS *Leach.* HYDROPHILUS p. *Fab.* 9 sp. *Hydr. truncatellus* F.
Subdepressed; apex of elytra truncate; eyes not prominent; sternum simple; max. palpi much longer than the antennæ. Steph. Ill. 2. pl. 14. f. 4.

HYDROPHILUS *Geoffr.** HYDROUS *Linn.* MSS. *Leach.* 1 sp. *Dyt. piceus* L.
Sternum very elevated and pointed; labrum entire; elytra narrowed behind; last joint of anterior male tarsi dilated; mandibles very much toothed. Curt. 239.

HYDROCHARIS *Latr.* { HYDROPHILUS *Leach.* / HYDROUS *Brullé.* } 1 sp. *Hydr. caraboides* Linn.
Metasternum keeled, not extending beyond the posterior trochanters; labrum emarginate; mandibles bifid at the apex, ciliated internally; ♂ tarsi simple. Curt. 159.

* Geoffroy's typical species of this genus was the Dyt. piceus *Linn.*, which ought surely to have been retained as the type, instead of assigning it to a MS. genus of Linnæus, and giving another species as the type of Geoffroy's genus. I have, therefore, followed Latreille in giving a new generic name of the Caraboides rather than adopt Brullé's plan of reversing Leach's application of these names.

BEROSUS *Leach.* HYDROPHILUS *Fab.* 4 sp. *Dyt. luridus* Linn. Curt. 240.
Sternum simple; labrum entire; antennæ 8-jointed; the club 3-jointed, obtuse; eyes rather prominent; elytra very gibbous, much broader than the thorax.

HYDROBIUS *Leach.* HYDROPHILUS *Fab.* 4 sp. *Dyt. fuscipes* Linn.
Sternum simple; labrum slightly emarginate; antennæ 9-jointed; body more or less elongate; elytra striated. Curt. 243.

PHILYDRUS *Solier.* HYDROBIUS A. b. *Steph.* 7 sp. *Hydr. melanocephalus* F.
Maxillary palpi much longer than the antennæ, with the last joint evidently shorter than the preceding; body oblong; elytra not striated. Herbst. 7. pl. 114. 4 D.

LACCOBIUS *Erichson.* LIMNEBIUS *Brullé.* 10 sp. *Hydr. bipunctatus* Fab.
Antennæ 8-jointed; terminal joints of max. palpi but slightly elongate, subequal; body subglobose; elytra punctate; posterior tibiæ not ciliated; tarsi slender, ciliated. Pz. 67. 14.

CHÆTARTHRIA *Waterh.* CYLLIDIUM *Erichson.* 1 sp. *Hydr. seminulum* Pk.
Palpi short; third joint short; fourth joint large; clava of antennæ 3-jointed; penultimate joint large; body very gibbous, not punctate; sternum simple. Herbst. 7. pl. 114. L.

Family 5. *SPHÆRIDIIDÆ Leach.*

SPHÆRIDIUM *Fabr.* DERMESTES *Linn.* 7 sp. *D. scarabæoides* Fab.
Mentum flat; palpi slender; club of antennæ slightly imbricated. Curt. 518.

CERCYON *Leach.* SPHÆRIDIUM *Fabr.* 61 sp. *Scarab. quisquilius* Linn.
Mentum broad, flat; palpi slender; club of antennæ large. Herbst. Col. 4pl. 37. L.

CYCLONOTUM *Erich.* { CÆLOSTOMA *Brullé.** / HYDROBIUS *Steph.* } 1 sp. *Hydr. orbicularis* Fab.
Mentum impressed in the centre; palpi thick; club of antennæ slighly imbricated; antennæ 9-jointed; lobes of maxillæ coriaceous. Pz. 76. 13.

Family 6. *AGATHIDIIDÆ* Westw. (Anisotomidæ *Steph.*).

PHALACRUS *Payk.* ANISOTOMA p. *Illig.* 28 sp. *Ph. corruscus* Pk.
Broadly ovate, very convex; palpi short, filiform; third tarsal joint bilobed; antennæ remote; clava 3-jointed. Sturm. D. F. 11. pl. 30.

EPHISTEMUS *Westw.* DERMESTES p. *Marsh.* 4 sp. *Der. Gyrinoides* Marsh.
Elongate, ovate, narrowed at each end; antennæ approximated at the base; club 3-jointed; head exposed. Steph. I. M. 2. pl. 15.

ALEXIA *Steph.* TRITOMA p. *Germar.* 3 sp. *Trit. pilifera* Germ.
Very convex; terminal joint of palpi thick, obtuse; club of antennæ 3-jointed; head large, deflexed; thorax short, emarginate.

LEIODES *Latr.* ANISOTOMA *Illig.* 33 sp. *Te. cinnamomea* Pz. Curt. 251.
Ovate, head exposed, moderate; legs spined; antennæ remote; club 5-jointed, its second joint minute.

AGATHIDIUM *Illig.* VOLVOXIS p. *Kug.* 15 sp. *Silpha seminulum* L.
Body globose, hemispheric; contractile into a ball; head very broad; club of antennæ 3-jointed. Sturm. D. F. 2pl. 26.

CLAMBUS *Fisch.* PTILIUM *Schüpp.* 5 sp. *Dermest. armadillo* D. G.
Body broadly ovate, depressed behind; contractile into a ball; head very broad; club of antennæ apparently 2-jointed; tarsi 4 or 5-jointed. De Geer 4. pl. 8. 21.

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* I should have adopted Brullé's name for this Genus, having the priority, but it has been long previously used by MacLeay, in the *Annulosa Javanica.*

CORYLOPHUS *Leach.* CLYPEASTER *Andersch.* 1 sp. *Derm. cassidoides* Marsh.
Ovate, subdepressed; head small, hidden beneath the semioval pronotum; elytra rounded at the tips; club of antennæ 3-jointed.

ORTHOPERUS *Steph.* DERMESTES p. *Marsh.* 6 sp. *Derm. punctum* M.
Subovate, subconvex; club of antennæ 2-jointed; head small; elytra subtruncate at the tip.

SERICODERUS *Steph.* SCAPHIDIUM p. *Marsh.* 1 sp. *Scaph. dubium* M.
Subconvex, sericeous; club of antennæ 3-jointed; head small, concealed; elytra distinctly truncate behind.

Stirps 2. *Necrophaga* Latr. MacL. (Silpha and Dermestes *Linn.*)

Family 1. *SCAPHIDIIDÆ* MacL. (Scaphidiles *Latr.*)

SCAPHIDIUM *Olivier*, &c. 1 sp. *Scaph. 4-maculatum* Oliv. Curt. 379.
Elytra truncate; scutellum distinct; club of antennæ with the second joint larger than the first.

SCAPHISOMA *Leach.* SILPHA p. *Linn.* 2 sp. *Silph. agaricina* Linn.
Elytra truncate; scutellum indistinct; second joint of club of antennæ smaller than the rest. Panz. 12. 16.

MYLÆCHUS *Latr.* CATOPS p. *Payk.* 1 sp. *Myl. brunneus* Latr.
Elytra oval; posterior angles of thorax acute; club of antennæ with the second joint not smaller than the preceding. Latr. Gen. pl. 8. f. 11.

PTOMAPHAGUS *Illig.* CHOLEVA p. *Spence.* 7 sp. *Pt. truncatus* Ill.
Elytra oval; posterior angles of thorax acute; eighth joint of antennæ small; elytra not striated. Pz. 73. 10.?

CATOPS *Payk.* CHOLEVA p. *Spence.* 17 sp. *Helops chrysomeloides* Pz.
Elytra oval; posterior angles of thorax acute; elytra striated; eighth joint of antennæ small. Curt. 566.

CHOLEVA *Latr.* PTOMAPHAGUS p. *Ill.* 3 sp. *Pt. agilis* Ill. Panz. 18. f. 1.
Elytra oval; posterior angles of thorax obtuse; elytra striated; antennæ moderately long.

Family 2. *SILPHIDÆ* Leach. (Silphales *Latr.*)

SPHÆRITES *Duftsch.* SARAPUS *Fisch.* 1 sp. *Hister glabratus* Fab.
Body quadrate; club of antennæ solid, 4-jointed; elytra truncate; mandibles bidentate; maxillæ with an internal horny tooth. Sturm. D. F. 1. pl. 20.

NECROPHORUS *Fab.* NECROPHAGUS *Leach. Oliv.* 7 sp. *Silpha Vespillo* L.
Body oblong; elytra truncate; club of antennæ large, round, 4-jointed, perfoliate; maxillæ unarmed. Curt. 71.

NECRODES *Wilkin.* SILPHA p. *Linn.* 1 sp. *Silph. littoralis* Linn. Curt. 334.
Body oblong; elytra truncate; club of antennæ gradually thickened; maxillæ with a claw.

OICEOPTOMA *Leach.* PELTIS p. *Geoff.* 3 sp. *Silpha thoracica* Linn.
Body oval, depressed; club of antennæ abrupt, 4-articulate; elytra ♀ rounded. Donov. 3. pl. 63.

THANATOPHILUS *Leach.* OICEOPTOMA p. *Steph.* 2 sp. *Silpha sinuata* Linn.
Oval, depressed; club of antennæ abrupt, 4-jointed; elytra ♀ notched near the tip. Donov. 15. 539.

SILPHA *Linn.* &c. ——— 8 sp. *Silpha 4-punctata* Linn. Donov. 2. pl. 86.
Oval, slightly convex; antennæ gradually thickened; club 4-jointed; thorax often anteriorly truncate.

PHOSPHUGA *Leach.* Peltis p. *Müll.* 2 sp. *Silph. atrata* Linn.
Broadly ovate, margined; antennæ gradually thickened; club 3-jointed; thorax entire in front. Steph. 3. pl. 16. f. 3.

Family 3. *NITIDULIDÆ* MacL. (Nitidulariæ *Latr.*)

THYMALUS *Latr.* Peltis p. *Payk.* 1 sp. *Cass. limbata* Fab. Curt. 39.
Body nearly hemispheric; elytra entire; thorax margined; maxillæ with a corneous hook; mandibles bifid at the tip; tarsal third joint simple.

NITIDULA *Fab.* Silpha p. *Linn.* 28 sp. *Silph. grisea* Linn. Curt. 675.
Body oval, subdepressed; thorax margined; tibiæ compressed; tarsal fourth joint bilobed; third joint of antennæ longer than the fourth.

STRONGYLUS *Herbst.* Nitidula p. *Latr.* 4 sp. *Nitid. strigata* Fabr.
Body oval, subconvex; sides of thorax not depressed; terminal joint of antennæ mamillate; third joint of antennæ longer than the fourth. Curt. 339.

CAMPTA *Kirby.* Cychramus p. *Kugell.* 1 sp. *Strong. luteus* Hbst.
Body nearly hemispherical, not margined, tomentose; third joint of antennæ not larger than the fourth; club large; tibiæ dilated. Hbst. 4. pl. 43. f. 3.

MELIGETHES *Kirby.* Laria *Scopoli.* 15 sp. *Nitid. viridescens* Fab.
Body subquadrate, metallic coloured; elytra entire; third joint of antennæ as long as fourth and fifth united; tibiæ spinulose. Pz. 83. 7.

PRIA *Kirby.* Silpha p. *Marsh.* 1 sp. *Silph. truncatella* Marsh.
Subdepressed; elytra convex, subtruncate; club of antennæ 4-jointed, serrated, sixth and seventh joints with an external process.

CARPOPHILUS *Leach.* Dermestes p. *Linn.* 2 sp. *Derm. hemipterus* Linn.
Oblong, ovate, subdepressed; elytra scarcely covering more than half the abdomen; antennæ with the third joint short. Hbst. 5. 34. E.

CATERETES *Herbst.* Cercus *Latr.* 12 sp. *Dermest. bipustulatus* Payk.
Ovate, subconvex; elytra truncate; antennæ rather long; club slender. Panz. 7. 5.

ANISOCERUS *Howitt.* ——— 1 sp. *Anis. Spiræ* How. Steph.
Ovate, subconvex; elytra truncate; two basal joints of antennæ very large, especially in the males.

BYTURUS *Latr.* Dermestes p. *Fabr.* 1 sp. *Derm. tomentosus* Fab.
Oblong, ovate, subconvex; tarsal third joint bilobed; antennæ gradually thickened; Curt. 618.

MICROPEPLUS *Latr.* Omalium p. *Gyll.* 4 sp. *Micr. porcatus* Payk.
Broad, oblong, depressed; elytra truncate, ribbed; club of antennæ solid. Curt. 204.

Family 4. *ENGIDÆ* MacLeay.

Subfamily 1. *Trogositides* Westw. (Trogositidæ and Engidæ *Steph.*).

IPS *Herbst.* Silpha p. *Linn.* 6. sp. *Silph. 4-pustulata* Linn. Curt. 306.
Tarsi 5-jointed; maxillæ produced into a broad lobe; body oblong, subdepressed; legs short; tibiæ broad, serrated.

NEMOSOMA *Latr.* Dermestes p. *Linn.* 1 sp. *Derm. elongatus* Linn.
Body very long, slender, cylindric; head as large as thorax; tarsi 4-jointed; maxillæ produced into a single pilose lobe. Curt. 327.

TROGOSITA *Fabr.* Tenebrio p. *Linn.* 1 sp. *Tenebr. mauritanicus* Linn.
Body oblong, ovate, depressed; tarsi 5-jointed; basal joint minute; maxillæ produced into a single slender lobe. Sturm. D. F. and my *fig.* 11. 14—21.

RHYZOPHAGUS *Herbst.* Lyctus p. *Fab.* 11 sp. *Lyct. bipustulatus* Fab.
Body narrow, subdepressed; head large; tarsi heteromerous; outer lobe of maxillæ slender, articulated at the top. Curt. 579.

CERYLON *Latr.* Lyctus p. *Fabr.* 4 sp. *Lyct. histeroides* Pz. Pz. 5. 16.
Body oblong, ovate, depressed; head broad; maxillary palpi filiform; the last joint rather attenuated and truncate.

ANOMMATUS *Wesmael.* Cerylon p. *Steph.* 1 sp. { *Lyct. obsoletus* Spence. / *An. terricola* Wesm.
Sides of thorax somewhat dilated; eyes entirely obsolete.

COLYDIUM *Herbst.* Ips p. *Oliv.* 1 sp. *Col. elongatum* Fab. Panz. 3. f. 12.
Body linear, subconvex; legs very short; club of antennæ 3-jointed; tars 4-jointed; outer lobe of maxillæ large; inner lobe slender.

ENGIS *Latr.* Ips p. *Herbst.* 3 sp. *Ips rufifrons* Fab. Panz. 36. f. 19.
Oblong, ovate, subconvex; tarsi 5-jointed, fourth joint short; maxillæ bilobed; club of antennæ short, broad, flattened, and 3-jointed.

BITOMA *Herbst.* Ditoma *Latr.* 1 sp. *Bit. crenata* Herbst. Curt. 283.
Oblong, depressed; tarsi 4-jointed; club of antennæ 2-jointed; thorax carinated.

MONOTOMA *Herbst.* Cerylon p. *Gyll.* 3 sp. *Mon. picipes* Hbst.
Oblong, ovate, depressed; thorax narrower than the elytra, crenulated; femora thickened; antennæ with the club large, 1-jointed, with a terminal appendage. Hbst. V. pl. 46, 2.

CICONES *Curtis.* Synchita p. *Hellw.* 1 sp. *Syn. variegata* Hellw. (*Carpini* C.)
Oblong, ovate, subconvex; tarsi 4-jointed; club of antennæ 1-jointed, large, orbicular; maxillæ with two equal lobes. Curt. 149.

LYCTUS *Fab.* Ips p. *Oliv.* 1 sp. *Lyct. canaliculatus* Fab. Hbst. C. 5 pl. 46.
Elongate, subdepressed; thorax subquadrate, channelled, margins crenulated; club of antennæ 2-jointed; terminal joint acute.

(XYLOTROGUS *St.* Lyctus p. *Chevr.* 1 sp. *Xyl. brunneus* St. St. 3. pl. 18. 4.)

LISSODEMA *Curtis.* ——— 1 sp. *Liss. Heyana* Curt.
Body elliptic, convex; elytra very long; club of antennæ 3-jointed; thorax with the margins denticulated; tarsi heteromerous.

CRYPTOPHAGUS *Herbst.* Ips p. *Oliv.* 15 sp. *Derm. cellaris* Fab.
Body ovate, subconvex; lateral margins of thorax denticulated; tarsi in one sex heteromerous; club of antennæ 3-jointed; mandibles bifid at the tips. Curt. 160.

ANTHEROPHAGUS *Megerle.* Cryptophagus *Gyll.* 4 sp. *Tenebr. pallens* Linn.
Oblong, ovate; club of antennæ 3-jointed; margins of thorax entire; tarsi in one sex heteromerous; tibiæ dilated at the tips. Curt. 546.

Subfamily 2. *Cucujides* Westw. (Cucujipes *Latr.*).

CUCUJUS *Fabr.* Colydium p. *Herbst.* 9 sp. *Cucujus dermestoides* Fab.
Antennæ short, moniliform or clavate; the basal joint short. Curt. 510.

ULEIOTA *Latreille.* Brontes p. *Fabr.* 2 sp. *Br. flavipes* Fabr. Panz. 95. 4.
Antennæ as long as the body, filiform; basal joint longer than the head; the male of the last named insect is remarkable for the large and curious bent hook with which the mandibles are furnished.

Family 5. *PAUSSIDÆ* Westw.

There is no British species of this family.

Family 6. *MYCETOPHAGIDÆ* Westw. (Engidæ p. *Steph.*)

MYCETOPHAGUS *Fab.* Boletaria *Marsh.* 6 sp. *Chrysom. 4-pustulata* Linn.
Body ovate, subconvex; antennæ with a slender 5-jointed club; tarsi composed of four simple joints, except the anterior pair in ♂ which are 3-jointed. Curt. t56. and my *fig.* 13. 1—9.

TETRATOMA *Herbst.* Boletaria p. *Marsh.* 4 sp. *Tetrat. fungorum* Herbst.
Body oblong, convex; tarsi heteromerous; club of antennæ 4-jointed; mandibles bifid at tip. Curt. 123.

BIPHYLLUS *Dej.* Bitoma p. *Gyll.* 1 sp. *Derm. lunatus* Fab.
Body ovate, subconvex; club of antennæ 2-jointed; thorax with an elevated lateral line on each side. Steph. Ill. M. v. 3. pl. 17. 3.

TRIPHYLLUS *Meg.* Mycetophagus p. *Gyll.* 2 sp. *Ips punctata* Fab.
Body oblong, ovate, subconvex; club of antennæ 3-jointed; basal joint thickened; tarsi 5-jointed. Steph. 3. pl. 17. 2.

PHLOIOPHILUS *Waterh.* ——— 3 sp. *Phl. Edwardsii* Waterh.
Body oblong, ovate, very convex; two basal joints of antennæ thickened, globose; club 3-jointed; last joint of max. palpi thick, conical. Steph. 3. pl. 18. f. 1.

PSAMMÆCHUS *Boudier.* Crypta *Kirby.* 1 sp. *Anthicus bipunctatus* Fab.
Basal joints of tarsi bilobed; palpi large, last joint securiform; margins of thorax anteriorly notched. This difficult genus seems incorrectly located. Panz. 26. 9.

TYPHŒA *Kirby.* Pentaphllyus p. *Dej.* 4 sp. *Mycet. testaceus* Fab.
Oblong, ovate, depressed; palpi short, subfiliform; antennæ with the basal joint large; club 3-jointed; tarsi pentamerous; heteromerous in one sex.

MYCETÆA *Kirby.* Dermestes p. *L.* 1 sp. *Derm. fumatus* L. (*M. hirta* Curt.)
Ovate convex, hirsute; max. palpi slender; labial short, thickened; club of antennæ 3-jointed; tarsi 4-jointed; third joint minute. Steph. 3. pl. 17. fig. 1.

PARAMECOSOMA *Curt.* ——— 1 sp. *Par. bicolor* Curt. Curt. 606.
Elongate, ovate, slightly depressed; club of antennæ 3-jointed; thorax transverse, quadrate; tarsi pentamerous.

ATOMARIA *Kirby.* Corticaria p. *Marsh.* 20 sp. *Derm. nigripennis* Pk.
Elongate, ovate, subdepressed; antennæ remote at the base; basal joint of antennæ large; second small; club 3-jointed; margins of thorax entire. Pz. 99. 13.

ANISARTHRIA *Waterh.* Dermestes p. *Marsh.* 9 sp. *Derm. Melas.* M.
Broad, subovate, subconvex; club of antennæ 3-jointed; tenth joint minute.

TRICHOPTERYX *Kirby.* Ptilium *Schüpp.* 7 sp. *Dermestes atomarius* De G.
Oblong, quadrate; wings very narrow, margined with very long hairs. De G. 4. pl. 8.

HOLOPARAMECUS *Curt.* ——— 1 sp. *Hol. depressus* Curt.
Oblong, depressed; antennæ 10-jointed *; club 2-jointed; thorax obcordate; tarsi 3-jointed. Curt. 614.

SILVANUS *Latr.* Colydium p. *Payk.* 1 sp. *Derm. Surinamensis* Linn.
Elongate, narrow, depressed; antennæ 11-jointed; club 3-jointed; tarsi 4-jointed. Pz. 14. 11.

LATRIDIUS *Herbst.* Corticaria p. *Marsh.* 11 sp. *Tenebr. lardarius* Dej.
Elongate, depressed; elytra subovate; thorax narrow, margined; antennæ 11-jointed; club 3-jointed; tarsi 4-jointed. Curt. 311.

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* Curtis incorrectly described the antennæ of this genus as 9-jointed. It is evidently an imported species. I have it from Sierra Leone.

CORTICARIA *Marsh.* LATRIDIUS p. *Herbst.* 11 sp. *Latr. pubescens* Illig.
Oblong, subconvex; thorax subcordate, immarginate; tarsi 4-jointed Hbst. 4. pl. 20. B.

EUTHEIA *Waterh.* ——— 1 sp. *Euth. Scydmænoides* Steph.
Oblong, ovate; elytra plicate at base, truncate at tips; antennæ thick; club 3-jointed; tarsi 5-jointed. Steph. 3. pl. 18. f. 2.

Family 7. *DERMESTIDÆ* Leach. (Dermestes *Linn.*)

DERMESTES *Linn. &c.* ——— 4 sp. *Derm. lardarius* Linn.
Oblong, ovate; max. palpi shorter than the maxillæ; antennæ short; club large, 3-jointed. Curt. 682.

TIRESIAS *Steph.* CTESIAS *Steph. olim.* 1 sp. *Derm. Serra* Fab.
Ovate, subdepressed; club of antennæ internally serrated, 3-jointed; thorax lobed behind. Curt. 244.

MEGATOMA *Herbst.* ATTAGENUS p. *Latr.* 1 sp. *Derm. undatus* Linn.
Elongate, ovate, elytra parallel; club of antennæ perfoliate; last joint of palpi ovate, truncate. Panz. 75. 18.

ATTAGENUS *Latr.* MEGATOMA p. *Herbst.* 2 sp. *Derm. Pellio* Linn. Curt. 247.
Ovate; terminal joint of antennæ very long in ♂, last joint of palpi, elongate; basal joint of posterior tarsi minute.

ANTHRENUS *Geoff.* BYRRHUS p. *Linn.* 5 sp. *Byrr. Museorum* Linn.
Broad, subconvex, squamose; club of antennæ solid, 3-jointed; thorax lobed behind, with lateral grooves beneath for the reception of the antennæ. Sturm. D. F. 2. pl. 36.

Stirps 3. *Brachelytra* Latr. (Microptera *Grav.*) Comprising the single

Family. *STAPHYLINIDÆ.* (Staphylinus *Linn.*)

Subfamily 1. *Staphylinides* Mannerh. (Staphylinidæ *MacL.*)

VELLEIUS *Leach.* STAPHYLINUS p. *Payk.* 1 sp. *St. dilatatus* Pk.
Antennæ serrated after the third joint; thorax suborbicular. Steph. 5. pl. 26. f. 6.

CREOPHILUS *Kirby.* STAPHYLINUS p. *Linn.* 2 sp. *St. maxillosus* Linn.
Antennæ short, subclavate; head and thorax glabrous; thorax semiorbicular. Donov. 3. pl. 96.

EMUS *Leach.* CREOPHILUS p. *Kirby.* 1 sp. *Staph. hirtus* Linn. Curt. 534.
Antennæ short, with the 6-terminal joints subtransverse; head and thorax pilose; thorax semiorbicular.

TRICHODERMA *Steph.* STAPHYLINUS p. *St. olim.* 3 sp. *Staph. murinus* Linn.
Body entirely pilose; antennæ with the last joint obliquely excised, the fourth and tenth joints nearly equal; thorax subquadrate; posterior angles rounded. Panz. 66. 16.

STAPHYLINUS *Linn. &c.* ——— 8 sp. *St. erythopterus* Linn.
Body nearly glabrous; antennæ subfiliform, with the fourth and tenth joints subequal; thorax subquadrate. Donov. 9. pl. 308.

GOERIUS *Leach.* OCYPUS p. *Kirby.* 3 sp. *Staph. olens* Linn.
Antennæ rather long, filiform; terminal joint oblique at the tip; head large; mandibles dissimilarly toothed. K. and S. *Intr.* 1. pl. 1. f. 2.

OCYPUS *Kirby.* STAPHYLINUS p. *Oliv.* 4 sp. *St. similis* Oliv.
Mandibles long, slender, without teeth; lateral palpi subclavate. Oliv. 3. pl. 5. f. 42.

TASGIUS *Leach.* ASTRAPÆUS p. *Latr.* 2 sp. *Astr. rufipes* Latr. Curt. 438.
Antennæ filiform; maxillary palpi short, last joint small, truncate; labial palpi securiform in one sex; thorax punctured.

ASTRAPÆUS p. *Grav.* STAPHYLINUS *Oliv.* 1 sp. *St. ulmi* Oliv. Oliv. 3. pl. 4. f. 37.
All the palpi with the last joint securiform.

OXYPORUS *Fabr.* STAPHYLINUS *Linn.* 2 sp. *St. rufus* Linn. Curt. 418.
Max. palpi filiform; last joint of labial palpi lunate; mandibles porrected entire.

QUEDIUS *Leach.* STAPHYLINUS *Auct.* 37 sp. *Staph. impressus* Grav.
Narrow; palpi long, slender; mandibles short, irregularly subdentate; head rather small, subovate; anterior tarsi greatly dilated; antennæ short, slender. Panz. 36. f. 21.

MICROSAURUS *Dej.* QUEDIUS p. *Steph. and Curt.* 1 sp. *Staph. lateralis* Grav.
Broad; antennæ very short, stout; terminal joints increasing in size; palpi long and slender; mandibles long, very curved, Curt. 638.

PHILONTHUS *Leach.* STAPHYLINUS *Auct,* 50 sp. *Staph. politus* Linn.
Palpi short, filiform; mandibles with a strong central tooth; thorax quadrate; anterior tarsi moderately dilated; antennæ filiform. Curt. 610.

RAPHIRUS *Leach.* STAPHYLINUS *Auct.* 13 sp. *St. attenuatus* Gr.
Body attenuated at each end; eyes very large; abdomen conic; antennæ slender; anterior tarsi moderately dilated.

BISNIUS *Leach.* STAPHYLINUS *Auct.* 6 sp. *St. cephalotes* Grav.
Depressed; eyes moderate; head rather large; last joint of antennæ abruptly acute; abdomen broad.

CAFIUS *Leach.* STAPHYLINUS *Auct.* 2 sp. *Staph. Xantholoma* Grav. Curt. 322.
Depressed; eyes small; head larger than the thorax; abdomen oblong, broader than the thorax; terminal joint of antennæ entire, ovate; anterior tarsi dilated.

GABRIUS *Leach.* STAPHYLINUS p. *Auct.* 13 sp. *St. aterrimus* Gr.
Anterior tarsi simple; abdomen rather slender; last joint of max. palpi subulate.

REMUS *Holme.* ———— 1 sp. *R. Sericeus* Holme. Ent. Tr. 2. p. 1.
Thorax closely punctate; antennæ not geniculate; body depressed; tibiæ simple.

OTHIUS *Leach.* XANTHOLINUS p. *Dahl.* 11 sp. *Staph. fulgidus* Payk.
Linear, very long; antennæ filiform, not elbowed; terminal joint of palpi conic. Panz. 27. 23.

HETEROTHOPS *Kirby.* STAPHYLINUS p. *Grav.* 3 sp. *St. binotatus* Grav.
Anterior tarsi simple; antennæ straight; terminal joint of palpi very minute; head small, suborbicular.

GYROHYPNUS *Kirby.* XANTHOLINUS p. *Dahl.* 21 sp. *Staph. tricolor* Pk.
Tarsi simple; antennæ inserted between the eyes, geniculated; terminal joint of palpi oblong, ovate. Oliv. 3. pl. 5. f. 50.

ACHENIUM *Leach.* LATHROBIUM p. *Grav.* 1 sp. *Lath. depressum* Grav.
Body depressed; antennæ long, filiform, straight; last joint of palpi very small; tarsi dilated. Curt. 115.

LATHROBIUM *Grav.* PÆDERUS *Fabr.* 15 sp. *Staph. elongatus* Linn.
Very long, narrow, subconvex; anterior tarsi dilated; antennæ short, straight; terminal joint of palpi minute. Curt. 650.

CRYPTOBIUM *Mann.* OCTHEPHILUM *Steph. olim.* 1 sp. *Pæd. fracticornis* Fab.
Long, narrow, subconvex; antennæ elbowed; last joint of max. palpi very minute; first joint of tarsi longer than the following. Step. 5. pl. 27.

Subfamily 2. *Stenides* Mann. (Longipalpi *Latr.*, Stenidæ *MacLeay*).

SUNIUS *Leach.* Pæderus p. *Fabr.* 4 sp. *Pæd. melanocephalus* Fab.
Thorax subquadrate, depressed, as large as the head; eyes small; tarsi simple; tibiæ entire. Oliv. 3. pl. 1. f. 4.

ASTENUS *Dej.* Sunius p. *Leach.* 5 sp. *St. angustatus* Fab. Don. 16. 573.
Thorax suborbicular; head large; fourth tarsal joint bilobed;

RUGILUS *Leach.* Stilicus *Latr.* 4 sp. *Pæd. orbiculatus* Fab. Curt. 168.
Head large, orbicular; thorax small, narrowed in front; tarsi entire; labrum notched.

MEDON *Steph.* ——— 1 sp. *Med. Ruddii* Steph. Steph. 5. pl. 27. f. 2.
Head large, subquadrate; thorax subquadrate, as large as the head; labrum notched in the middle; mandibles internally 4-dentate; tarsi entire.

PÆDERUS *Fabr.* Staphylinus p. *Linn.* 5 sp. *St. riparius* Linn. Curt. 108.
Head large; thorax obovate, convex, larger than the head; eyes small; fourth tarsal joint bilobed.

STENUS *Latr.* Pæderus p. *Oliv.* 66 sp. *Staph. bipustulatus* Linn. Curt. 164.
Head and eyes very large; thorax elongate-ovate; labium elongate, retractile; abdomen simple.

DIANOUS *Leach.* Stenus p. *Latr.* 1 sp. *S. cærulescens* Gyll. Curt. 107.
Eyes moderate; anal setæ long; labium not elongated.

Subfamily 3. *Oxytelides.* (Stenidæ p. *Steph.*, Denticrura *Latr.*)

SIAGONIUM *Kirby.* Prognathus *Latr.* 1 sp. *Siag. 4-corne* K. Curt. 23.
Depressed; tarsi distinctly 5-jointed; labium deeply notched; antennæ not elbowed; head ♂ cornuted.

BLEDIUS *Leach.* Oxytelus p. *Grav.* 3 sp. *Staph. tricornis* Pk. Curt. 143.
Narrow, convex; anterior tibiæ toothed; antennæ elbowed; head and thorax ♂ cornuted.

HESPEROPHILUS *Steph.* Oxytelus p. *Grav.* 5 sp. *Oxyt. fracticornis* Gr.
Narrow, subconvex; antennæ elbowed; head and thorax ♂ unarmed; terminal joint of palpi slender.

PLATYSTETHUS *Mann.* Oxytelus p. *Grav.* 9 sp. *Staph. morsitans* Pk.
Short, broad in front; head lobed; all the tibiæ denticulato-pectinate; thorax convex, channelled. Oliv. 3. pl. 5. 48.

OXYTELUS *Grav.* Staphylinus p. *Linn.* 19 sp. *Staph. piceus* Linn.
Elongate, sublinear; head unarmed; two posterior tibiæ simple; thorax depressed, channelled. Panz. 27. 14.

APLODERUS *Steph.* Staphylinus p. *Marsh.* 1 sp. *St. brachypterus* M.
Thorax subdepressed, not channelled; abdomen broadest behind; head small, orbicular; terminal joint of palpi minute; elytra short.

TROGOPHLÆUS *Mann.* Oxytelus p. *Grav.* 1 sp. *Oxyt. corticinus* Grav.
Linear, depressed; tibiæ unarmed, ciliated; antennæ elbowed; last joint of palpi minute.

CARPALIMUS *Kirby.* Oxytelus p. *Gyll.* 9 sp. *Ca. bilineatus* K.
Antennæ straight; thorax cordate-truncate, sculptured; tibiæ simple; tarsi indistinctly 3-jointed. Steph. 5. 27. f. 4.

TÆNOSOMA *Mann.* Aleochara p. *Gyll.* 1 sp. *Al. pusilla* Grav.
Linear, narrow; tarsi 5-jointed, last joint long; last joint of maxillary palpi small, subulate.

PHLOEOCHARIS *Mann.* ——— 1 sp. *P. subtilissima* Mann.
Sublinear; basal joints of 4 ant. tarsi dilated; last joint of max. palpi acicular. (Ent. Mag. 24. 408.)

COPROPHILUS *Latr.* ELONIUM *Leach.* 1 sp. *Staph. striatulus* Fab.
Linear, narrow, depressed; tibiæ spinulose; tarsi 5-jointed; last joint of maxillary palpi largest, conic, truncate.

Subfamily 4. *Omalides.* (Applatis *Latr.*, Omalidæ *MacL.*)

EVÆSTHETUS *Gravenh.* ERISTHETUS *Lam.* 1 sp. *Ev. scaber* Gr.
Linear, subcylindric; antennæ clavate; max. palpi long, 3-jointed; thorax foveated. Ahrens, 7. 13.

SYNTOMIUM *Curt.* EVÆSTHETUS p. *Kirby.* 1 sp. *Synt. nigroœneum* K.
Broad, depressed; antennæ clavate; labrum deeply notched; margins of thorax crenulated. Curt. 228.

PSEUDOPSIS *Newman.* ——— 1 sp. *Pseud. sulcatus* Newm.
Head narrow; antennæ filiform, thickened at the tips; terminal joint of max. palpi slender, acute, the preceding dilated; thorax nearly circular, sulcated; elytra wider than the thorax.

MEGARTHRUS *Kirby.* STAPHYLINUS p. *Oliv.* 9 sp. *St. depressus* Pk.
Broad, subdepressed; antennæ subclavate; labrum transverse; two basal joints of antennæ robust. Steph. 5. 27. 5.

PROTEINUS *Latr.* CATERETES p. *Sch.* 3 sp. *Derm. brachypterus* Pk.
Oval; antennæ clavate; club 3-jointed; palpi subulate; elytra more than half the length of abdomen. Pz. 4. 10.

ANTHOBIUM *Leach.* SILPHA p. *Marsh.* 24 sp. *Silph. torquata* Marsh.
Oval, subdepressed; elytra nearly covering the abdomen; thorax short, transverse. Panz. 24. 6.

CORYPHIUM *Kirby.* ——— 1 sp. *Cor. angusticolle* K.
Depressed oblong; head broader than the thorax; terminal joint of palpi incrassated.

MICRALYMMA *Westw.* ——— 1 sp. *M. Johnstonæ.*
Oblong, depressed; elytra very minute; thorax obcordate; abdomen long, much broader than the thorax, margined; labrum transverse, 3-lobed; tarsi with very long hairs. Mag. Zool. and Bot. vol. ii.

OMALIUM *Grav.* STAPHYLINUS *Pk.* 33 sp. *St. planus* Pk. Oliv. 3. pl. 3. 27.
Oblong-ovate, depressed; thorax short, transverse, or obcordate; antennæ short; terminal joint of palpi acute.

ACIDOTA *Kirby.* STAPHYLINUS p. *Fabr.* 2 sp. *St. crenatus* F.
Oblong-ovate, subconvex; antennæ long, subfiliform; labrum and mandibles entire; thorax ovate, broadest behind. Steph. 5. 27. f. 6.

LESTEVA *Latr.* STAPHYLINUS p. *Linn.* 14 sp. *St. caraboides* Linn.
Thorax obcordate; abdomen broad, depressed; antennæ filiform; elytra long; last joint of max. palpi subacuminate. Curt. 303.

Subfamily 5. *Tachyporides.* (Tachyporidæ *Steph.*)

Division 1. *Tachinidea* Westw. (Tachinides *Mann.*)

MEGACRONUS *Steph.* TACHINUS p. *Grav.* 8 sp. *St. analis* Oliv.
Elongate, narrow; thorax transverse, with rounded angles; last joint of antennæ long; palpi filiform; last joint as long as the preceding. Steph. 5. 26. 5. b.

MYCETOPORUS *Mann.* Ischnosoma *Steph.* 12 sp. *Tach. splendidus* Gr.
Slender, posteriorly attenuated; thorax broadest behind; last joint of max. palpi minute. Steph. *5.* 26. *5.* a.

BOLITOBIUS *Leach.* Tachinus p. *Grav.* 18 sp. *Staph. lunulatus* Linn.
Elongate-ovate, attenuated behind; head long; palpi slender; antennæ rather long. Don. 15. 532.

TACHYPORUS *Grav.* Oxyporus p. *Fabr.* 38 sp. *Staph. chrysomelinus* Linn.
Broad, posteriorly attenuated; palpi subulate; abdominal segments entire; head small. Panz. 9. 14.

TRICHOPHYA *Mann.* Tachyporus B. b. *Steph.* 1 sp. *Tach. nodicornis* K.
Short, rather broad; antennæ nodose, verticillate; terminal joint of max. palpi stout.

HYPOCYPHTUS *Schüpp.* Cypha *Kirby.* 5 sp. *Tach. granulum* Gr.
Globose, posteriorly attenuated; abdomen almost retracted beneath the elytra; club of antennæ distinct, 3-jointed.

CONURUS *Steph.* Tachyporus p. *Grav.* 12 sp. *Tach. bipustulatus* Fab.
Thorax transverse, broad behind; abdomen conical; last joint of max. palpi minute. Pz. 16. 21.

TACHINUS *Grav.* Staphylinus p. *Linn.* 26 sp. *St. silphoides* Linn.
Broad, posteriorly attenuated; palpi filiform; abdominal segments emarginate. Panz. 18. 20.

Division 2. *Aleocharidea* Westw. (Aleochari des *Mann.*)

ISCHNOPODA *Steph.* Aleochara A. *Steph. Cat.* 7 sp. *Aleoch. aterrima* Grav.
Thorax longer than broad; tarsi long, especially in the hind legs.

POLYSTOMA *Steph.* Aleochara p. *Steph. Cat.* 3 sp. *Al. crassicornis* K.
Densely pubescent; abdomen linear, obtuse; thorax broader than long; antennæ thick in the middle; mouth prominent.

DEINOPSIS *Matthews.* ——— 1 sp. *D. fuscatus* M. Ent. Mag. 22. 193.
Mandibles with two acute teeth, and broad internal denticulated lobe; maxillary internal lobe denticulated at the tip; labial palpi obsolete; tarsi 3-jointed; abdomen conical.

CENTROGLOSSA *Matthews.* ——— 6 sp. *C. conuroides* M.
Mandibles simple, with an internal serrated lobe; maxillary internal lobe long, sabre-shaped; labial palpi obsolete; labium with two long terminal processes. Ent. Mag. 22. 194.

GYMNUSA *Karsten.* Myllæna p. *Erichson.** 1 sp. *Al. dubia* Gr.
Antennæ filiform, straight; mouth rostrate; palpi short, last joint subulate.

DIGLOSSA *Haliday.* ——— 1 sp. *D. mersa* Hal. Ent. Mag. 4. p. 253.
Antennæ with the second joint very long; maxillæ with two very long lobes; labium with two long setaceous laciniæ in the place of palpi.

ZYRAS *Steph.* Aleochara p. *Kirby.* 1 sp. *Al. Haworthii* K.
Elytra very short; antennæ rather long, subgeniculated; last joint of palpi long, slender. Steph. *5.* 26. f. 3.

(PHLOEOPORA *Erichs.* Aleochara p. *Steph.* 1 sp. *Al. corticalis* Grav.)

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* Dr. Erichson gives Al. dubia as the type of his genus Myllæna, and the Aleoch. brevicollis *Pk.* (carnivora *Grav.* Steph. *5.* 433.) as the type of Gymnusa.

BOLETOCHARA *Mann.* Aleochara *Gyll.* 100 sp. *Aleoch. collaris* Grav.
Subdepressed posteriorly, sublinear; thorax broader than the head; antennæ geniculated; thickened to the tips, basal joint of tarsi longest. Steph. *5.* 26. 2.

OLIGOTA *Mann.* Aleochara C. b. 2. *Steph. Cat.* 6 sp. *Al. pusillima* Gr.
Subdepressed, not attenuated; tarsi slender, with equal joints; five terminal joints of antennæ dilated; legs pubescent.

OXYPODA *Mann.* Aleochara D. *Steph. Cat.* 17 sp. *Aleoch. ruficornis* Gr.
Posteriorly attenuated; antennæ rather long, subincrassate at the tip; basal joint of tarsi rather longer than the second; legs pubescent.

GYROPHÆNA *Mann.* Aleochara E. *Steph. Cat.* 8 sp. *St. nanus* Pk.
Short, depressed; thorax scarcely longer than the head, the latter rhomboid; elytra transverse; tarsal joints equal.

ALEOCHARA *Grav.* Aleochara F. *Steph. Cat.* 34 sp. *St. bipunctata* Gr.
Elongate, robust; thorax convex, broad; elytra transverse; antennæ thick, joints of equal length. Oliv. 3. pl. *5.* 44.

PELLA *Steph.* { Aleochara G. *Steph. Cat.* / Myrmedonia p. *Erichson.* } 5 sp. *Staph. limbatus* Pk.
Thorax broad, posteriorly subangulated on each side; antennæ thickened.

HOMALOTA *Mann.* Aleochara p. *Gyll.* 1 sp. *Al. plana* Gyll.
Linear, flat; thorax breadth of head; antennæ moniliform; last joint of tarsi long.

HYGRONOMA *Erich.* Homalota *Curt.* 1 sp. *H. dimidiata.* Curt. 514.
Linear, flat; tarsi 4-jointed; joints subequal.

ENCEPHALUS *Kirby.* Gyrophœna p. *Er.* 1 sp. *Enc. complicans* K.
Very broad; abdomen strongly margined; antennæ short, thick at tip; head small. Steph. *5.* 26. f. 4.

CALLICERUS *Grav.* Homalota p. *Erich.* 2 sp. *Call. Spencii* K. Curt. 443.
Oblong, depressed; last joint of antennæ very long; third joint of max. palpi swollen; fourth very minute.

(? PLACUSA *Erich.*? Aleochara p. *Steph.* 1 sp. *Al. pumilio* Grav. ?)

ASTILBUS *Dillw.* Drusilla *Leach.* 1 sp. *St. canaliculatus* Fab. Pz. 27. 13.
Narrow, depressed; abdomen broader than the thorax; palpi filiform; thorax oblong.

DINARDA *Leach.* Lomechusa p. *Grav.* 1 sp. *Lom. dentata* Gr. Curt. 410.
Broad; posterior angles of thorax acutely produced; terminal joint of antennæ elongate, conic; penultimate joint of abdomen simple.

ATEMELES *Dillw.* Gomiodes *Kirby.* 2 sp. *Lom. paradoxa* Gyll.
Broad; penultimate joint of abdomen emarginate, with lateral processes; second and third joints of antennæ small. Guérin Ic. 10. f. 6.

LOMECHUSA *Grav.* Staphylinus *Fab.* 1 sp. *St. emarginatus* F.
Broad; penultimate joint of abdomen emarginate and styliferous; antennæ fusiform. Oliv. 3. pl. 2. 12.

CALODERA *Mann.* Aleochara p. *Grav.* 1 sp. *Calo. nigrita* Mann.
Head exserted, broader than the base of thorax; thorax of equal breadth throughout; elytra entire at the base; tarsal joints equal.

FALAGRIA *Leach.* Aleochara p. *Grav.* 11 sp. *St. sulcatus* Pk. Curt. 429.
Head large, exserted; thorax broad at the apex; base of elytra not plicate; basal tarsal joint long.

AUTALIA *Leach.* Aleochara p. *Grav.* 6 sp. *Al. impressa* Grav.
Head exserted, large; thorax narrow at base; base of elytra plicate; tarsal joints equal. Oliv. 3. pl. *5.* 41.

Subfamily 6. *Pselaphides* Westw. (Pselaphidæ *Steph.*)

EUPLECTUS *Kirby.* Pselaphus p. *Reich.* 9 sp. *Ps. signatus* Reich.
Elongate, narrow, depressed; last joint of palpi ovate, conic; ditto of antennæ large. Denny, pl. 1.

TRIMIUM *Aubé.* Euplectus p. *Denny.* 1 sp. *Psel. brevicornis* Reich.
Elongate, subcylindric; last joint of palpi securiform; thorax ovate; last joint of antennæ very large. Denny, pl. 2. f. 4.

BYTHINUS *Leach.* Pselaphus p. Reich. 4 sp. *Ps. securiger* Reich.
Short, very convex; last joint of palpi large, securiform; thorax cordate; second joint of antennæ very large. Denny, pl. 3.

ARCOPAGUS *Leach.* Pselaphus p. *Reich.* 4 sp. *Ps. bulbifer* Reich. Curt. 422.
Short, very convex; thorax widest in front; second joint of antennæ moderate.

TYCHUS *Leach.* Pselaphus p. Payk. 1 sp. *Ps. niger* Pk. Denny, pl. 6.
Body short, convex; terminal joint of palpi internally greatly dilated, securiform; fifth joint of antennæ ♂ dilated; thorax not impressed.

TYRUS* *Aubé.* Bryaxis p. *Leach?* 1 sp. *Psel. mucronatus* Pz. Curt. 315. 1—5.
Tarsi didactyle; intermediate trochanters spinose; thorax nearly spherical.

BRYAXIS *Knoch.* Reichenbachia *Leach.* Z. J. 7 sp. *Staph. impressus* Pz.
Short, subconvex; last joint of palpi conical, externally somewhat dilated; thorax cordate, 3-foveated. Curt. 315.

BATRISUS *Aubé.* Bryaxis p. *Steph.* 1 sp. *Br. nigriventris* Denny.
Subelongate, subconvex; antennæ inserted in a lateral fossula; thorax with three longitudinal sulci. Denny, pl. 7. f. 1.

PSELAPHUS *Herbst.* Anthicus p. *Pz.* 4 sp. *Ps. Herbstii* Reich.
Body somewhat elongate; elytra and abdomen depressed; terminal joint of palpi long, clavate. Denny, pl. 9.

Tribe 2. *Chilognathomorpha* MacLeay.

Subtribe 1. *Cordylocerata* Westw.

Stirps 1. *Clavicornes* Stephens.

Family 1. *BYRRHIDÆ* Leach. (Byrrhus *Linn.*)

BYRRHUS *Linn.* Cistela p. *Marsh.* 10 sp. *B. pilula* Linn.* Curt. 135.
Ovate-globose, convex, sericeous; club of antennæ 5-jointed, gradually thickened to the tip.

NOSODENDRON *Latr.* Byrrhus p. *Panz.* 1 sp. *Sphær. fasciculare* F.
Hemispheric, ovate; antennæ with the third joint very long; club large, 3-jointed; elytra fasciculated. Curt. 246.

SYNCALYPTA *Dillw.* Chætophora *K.* 3 sp. *By. arenaria* St.
Hemispheric, ovate; antennæ with third joint small; club 3-jointed; elytra rigidly setose. Sturm, D. F. 2. pl. 35. e.

TRINODES *Meg.* Anthrenus p. *Fab.* 1 sp. *Anthr. hirtus* Fab. Pz. 11. 16.
Ovate, subconvex, densely pilose; legs slender; club of antennæ 3-jointed.

ASPIDIPHORUS *Zeigl.* Nitidula p. *Gyll.* 1 sp. *N. orbiculatus* G. Curt. 450.†
Suborbiculate; elytra rounded at tip; antennæ 10-jointed; club long, 3-jointed.

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* The type of this genus is the Pselaphus mucronatus of Panzor, which Stephens gives as synonymous with Bryaxis sanguineus, and Curtis figures the trochanters of this species with spines; I have therefore introduced Aubé's genus.

† Mr. Curtis's figure giving this insect the habit of a Hister, with posteriorly truncate elytra, is incorrect.

SIMPLOCARIA *Marsh.* Byrrhus *Ill.* 2 sp. *B. semistriatus* Ill. Curt. 335.
Ovate, convex; club of antennæ 5-jointed; last joint of palpi acuminate.

OOMORPHUS *Curt.* Byrrhus p. *Sturm.* 1 sp. *B. concolor* St. Curt. 347.
Broadly ovate; third tarsal joint bilobed; club of antennæ 5-jointed, eighth joint small.

LIMNICHUS *Zeigl.* Byrrhus *Duftsch.* 1 sp. *Limn. sericeus* Duft.
Ovate, convex; antennæ rather long; two basal joints short, thicker than the following; club 4-jointed.

Family 2. *HISTERIDÆ* Leach. (Hister *Linn.*)

PLATYSOMA *Leach.* Hololepta p. *Dej.* 2 sp. *Hist. depressus* Fab.
Flat; four posterior tibiæ with a row of small teeth. Panz. 80. 6.

HISTER *Linn.* Hister p. *Steph.* 21 sp. *H. unicolor* Linn. Curt. 470.
Subdepressed; four posterior tibiæ with two rows of spines; prosternum anteriorly lobed; outer striæ of elytra entire.

DENDROPHILUS *Leach.* Hister p. *Auct.* 1 sp. *Hist. punctatus* Pk.
Oval, or subglobose subconvex; four posterior tibiæ broad, externally angulated, with one row of spines. Pk. 7. f. 5.

PAROMALUS *Erich.* Dendrophilus p. *Leach.* 7 sp. *Hist. flavicornis* Hbst.
Oval, subdepressed; tibiæ narrow, subincurved; prosternum lobed in front. Pk. t. 8. f. 6.

SAPRINUS *Erich.* Hister p. *Steph.* 12 sp. *Hist. nitidulus* Fab. Pk. pl. 5. f. 3.
Short, subdepressed; prosternum anteriorly produced, but not lobed; outer striæ of elytra abbreviated.

ORTHOPHILUS *Leach.* Hister p. *Auct.* 2 sp. *H. sulcatus* Fab. Curt. 228.
Elytra deeply sulcate.

ABRÆUS *Leach.* Hister p. *Auct.* 2 sp. *H. globosus* Fab. Pk. t. 8. f. 2.
Subglobose; elytra smooth; tibiæ slender, entire; prosternum short.

Stirps 2. *Lamellicornes* Latr.

Race 1. *Priocera* Dumeril, comprising the single

Family *LUCANIDÆ* Leach. (Lucanus *Linn.*)

LUCANUS *Scop.* Platycerus *Geoff.* 1 sp. *L. cervus.* Curt. 490.
Depressed; mandibles ♂ very large; club of antennæ 4-jointed; pectinated.

DORCUS *MacL.* Platycerus *Latr.* 1 sp. *L. parallelipipedus* L.
Depressed; mandibles ♂ moderate; club of antennæ 4-jointed, subperfoliated; anterior tibiæ narrow, serrated. Donov. 8. 264.

PLATYCERUS *MacL.* Lucanus p. *Latr.* 1 sp. *L. caraboides* Linn.
Depressed; mandibles ♂ moderate; club of antennæ 4-lamellate; anterior tibiæ serrulate. Curt. 274.

SINODENDRON *MacL.* Synodendron* *Fab.* 1 sp. *Scar. cylindricus* Linn.
Cylindrical; head and thorax ♂ cornuted; club of antennæ 3-jointed. Curt. 478.

Race 2. *Petalocera* Dumeril. (Scarabæus *Linn.* Scarabæides *Lat.*)

Subrace 1. *Saprophaga* MacL.

Family 1. *GEOTRUPIDÆ* MacLeay.

GEOTRUPES *Latr.* Scarabæus *Fab.* 10 sp. *Scar. stercorarius* Linn.
Ovate-orbicular; third joint of antennæ longer than second; thorax and head ♂ unarmed. Curt. 266.

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* This must evidently have been a misprint, the name being evidently derived from Σινω (noceo), and Δενδρον (arbor), and not Σύν (cum), and the latter word, as suggested by Dumeril.

TYPHÆUS *Leach.* CERATOPHYUS *Fisch.* 1 sp. *Scar. typhæus* Linn.
Ovate-orbicular; third joint of antennæ longer than second; thorax ♂ cornuted. Sam. pl. 1. f. 1.

BOLBOCERUS *Kirby.* ODONTÆUS *Koppe.* 3 sp. *Scar. mobilicornis* Fab.
Suborbiculate; third joint of antennæ short; head and thorax ♂ cornuted. Curt. 259.

Family 2. *SCARABÆIDÆ* MacLeay.

COPRIS *Geoff.* SCARABÆUS *Linn.* 1 sp. *Sc. lunaris* Linn. Curt. 414.
Ovate, convex; last joint of labial palpi minute.

ONTHOPHAGUS *Latr.* COPRIS p. *Illig.* 10 sp. *S. vacca* Linn. Curt.
Broadly ovate, depressed; last joint of labial palpi evanescent.

Family 3. *APHODIIDÆ* MacLeay.

APHODIUS *Illig.* SCARABÆUS *Linn.* 58 sp. *Sc. fossor* Linn. Curt. 27.
Oblong; palpi with the last joint slender; maxillæ with a fleshy lobe.

PSAMMODIUS *Gyll.* APHODIUS p. *Illig.* 2 sp. *Aph. sulcicollis* Illig. Curt. 258.
Palpi with the last joint ovate; maxillæ with a horny lobe; thorax sulcated.

OXYOMUS *Esch.* APHODIUS p. *Curt.* 4 sp. *Aph. porcatus* Fab. Pz. 38. 13.
Clypeus emarginate, smooth; elytra deeply sulcated; thorax smooth.

Family 4. *TROGIDÆ* MacLeay.

ÆGIALIA *Latr.* APHODIUS *Illig.* 1 sp. *Scar. globosus* Panz. Donov. 14. 470.
Antennæ 9-jointed; body short, ovate, very gibbose; thorax smooth.

TROX *Fabr.* SCARABÆUS *Linn.* 4 sp. *Scar. subulosus* Linn. Curt. 574.
Antennæ 10-jointed; body subovate, convex; thorax rugose.

Family 5. *DYNASTIDÆ* MacLeay.

ORYCTES *Illig.* GEOTRUPES p. *Fab.* 1 sp. *Sc. nasicornis* Linn.
Maxillæ unarmed. Sturm. D. F. 1. pl. 4. 5.

DYNASTES *MacLeay.* GEOTRUPES p. *Fab.* 2 sp. *Sc. inermis* Martyn.
Maxillæ toothed. Martyn, pl. 4. f. 35.

Subrace 2. *Thalerophaga* MacLeay.

Family 1. (or 6.) *RUTELIDÆ* MacLeay.

Family 2. (or 7.) *ANOPLOGNATHIDÆ* MacLeay.
(There are no British species of either of these Families.)

Family 3. (or 8.) *MELOLONTHIDÆ* MacLeay.

SERICA MacLeay. TENUICRUSTA Voet. 1 sp. *Scar. brunneus* Linn.
Short, ovate; antennæ 10-jointed; claws bifid; last joint of palpi subacute. Pz. 95. 7.

OMALOPLIA *Köppe.* MELOLONTHA p. *Fabr.* 1 sp. *Mel. ruricola* Fab.
Short, convex; antennæ 10-jointed; claws bifid; last joint of maxillary palpi truncate. Donov. 11. 378.

RHISOTROGUS *Latr.* ZANTHEUMIA *Leach.* 2 sp. *Scar. solstitialus* Linn.
Antennæ 9-jointed; club 3-jointed; claws equal, simple. Mart. 2. 17.

MELOLONTHA *Fabr.* SCARABÆUS p. *Linn.* 3 sp. *Mel. vulgaris* Fab.
Antennæ 10-jointed; club 6-7-jointed; claws equal, with a basal tooth. Curt. 406.

PHYLLOPERTHA *Kirby.* ANOMALA p. *Köppe.* 3 sp. *Scar. horticola* Linn.
Antennæ 9-jointed; claws unequal; clypeus not produced; thorax narrow behind. Curt. 526.

ANOMALA *Köppe.* MELOLONTHA p. *Fabr.* 3 sp. *Mel. Frischii* Fab.
Antennæ 9-jointed; claws unequal; clypeus not produced; thorax broad behind. Don. 11. 390.

ANISOPLIA *Meg.* SCARABÆUS p. *Linn.* 1 sp. *Mel. austriaca** Herbst.
Antennæ 9-jointed; claws unequal; clypeus advanced, reflexed. Steph. 3. pl. 19. 1.

HOPLIA *Illig.* MELOLONTHA p. *Oliv.* 1 sp. *Mel. argentea* Oliv.
Antennæ 10-jointed; claws simple, but unequal. Oliv. 1. pl. 3. f. 22 a.

Family 4. (or 9.) *GLAPHYRIDÆ* MacLeay. (Anthobii *Latr.*)
(There is no British species of this Family.)

Family 5. (or 10.) *CETONIIDÆ* MacLeay. (Melitophili *Latr.*)

TRICHIUS *Fabr.* MELOLONTHA p. *Herbst.* 1 sp. *Scar. fasciatus* Linn.
Tomentose; metasternum not produced; anterior tibiæ 2-dentate; anus entire. Donov. 4. 140.

ALEUROSTICTUS *K. Zl. J.* GNORIMUS *St. Farg. & S.* 2 sp. *Sc. variabilis* L.
Glabrous; metasternum not produced; anterior tibiæ 2-dentate; anus notched. Curt. 286.

VALGUS *Scriba.* ACANTHURUS *Kirby.* 1 sp. *Scar. hemipterus* Linn.
Thorax with two longitudinal elevations; anterior tibiæ 5-dentate; abdomen ♀ terminating in a slender point. Hbst. 3. pl. 27. 13.

CETONIA *Fabr.* SCARABÆUS p. *Linn.* 2 sp. *Scar. auratus* Linn. Curt. 374.
Metasternum porrected; epimera very large; elytra sinuated at the sides.

Subtribe 2. *Priocerata* Westw. (Serricornes *Latr.*)

Stirps 1. *Macrosterni* Westw. (Sternoxi *Latr.*)

Family 1. *BUPRESTIDÆ* Leach. (Buprestis *Linn.*)

CHRYSOBOTRIS *Esch.* BUPRESTIS A. a. *Steph.* 2 sp. *B. chrysostigma* Linn.
Scutel distinct, subtriangular; middle legs inserted close together; prosternum depressed; fore thighs thick and toothed; third joint of antennæ as long as fourth. Pz. 68. 18.

PŒCILONOTA *Esch.* LATIPALPIS p. *Solier.* 11 sp. *B. rutilans* Fab.
Scutel distinct, transverse; labrum rectangular; third joint of antennæ short; tarsi not dilated, with the fourth joint scarcely smaller than third. Pz. 22. 8.

DICERÆA *Esch.* LATIPALPIS p. *Sol.* 1 sp. *B. ænea* Linn. Herbst. 150. 9.
Scutel distinct, not transverse; last segment of abdomen 3-dentate in one sex, bidentate in the other; tarsi not dilated, fourth joint as large as third.

ANCYLOCHIRA *Esch.* BUPRESTIS p. *Sol.* 3 sp. *B. rustica* Linn.
Scutel distinct; mentum transverse, truncate in front; last joint of max. palpi as long as the preceding, slightly dilated at the tip; tarsi slender; anterior tibiæ ♂ bent and hooked. Pz. 68. 19.

MELANOPHILA *Esch.* BUPRESTIS p. *Sol.* 11 sp. *B. tarda* Fab.
Scutel distinct, triangular; thorax sinuated at the base; mentum transverse; anterior tibiæ ♂ simple; tarsi slender. Pz. 68. 21.

ANTHAXIA *Esch.* BUPRESTIS B. b. *Steph.* 4 sp. *B. nitidula* Linn.
Scutel distinct, triangular; thorax and elytra truncate at the base; antennæ scarcely dilated; posterior femora straight; middle legs close together. Curt. pl. 31.

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* This insect is incorrectly named Agricola by English Entomologists.

PTOSIMA *Serville.* AGRILUS p. *Esch.* 2 sp. *Bupr. 9-maculata* Linn.
Scutel distinct, rounded; thorax truncate at the base; mentum with a long central tooth. Pz. 68. 17.

AGRILUS *Megerle.* AGRILUS A. *Steph.* 4 sp. *Bupr. viridis* Linn. Curt. pl. 67.
Scutel distinct, triangular; thorax sinuated at base; tarsi with pulvilli beneath the four basal joints; tarsal claws toothed.

APHANISTICUS *Latr.* BUPRESTIS p. *Fab.* 1 sp. *Aph. pusillus* Gyll.
Middle legs wide apart; body linear; head notched; antennæ with the four terminal joints dilated. Curt. 262.

TRACHYS *Fab.* BUPRESTIS *Don.* 3 sp. *Bupr. minuta* Linn. Donov. 8. 256.
Short, broad; antennæ free, serrated towards the tips; scutel wanting; thorax posteriorly trilobed.

Family 2. *EUCNEMIDÆ* Westw.

Subfamily 1. *Eucnemides* Latreille.

MELASIS *Oliv.* ELATER p. *Linn.* 1 sp. *El. buprestoides* Linn. Curt. 55.
Antennæ distant at base, flabellate in the ♂; body cylindric; legs flattened.

MICRORHAGUS *Esch.* EUCNEMIS *Steph.* 1 sp. *Euc. pygmæus* Mann.
Body narrow, depressed; antennæ quite close together at the base; antennæ ♂ ramose; legs slender. Mann. Euc. pl. 2. f. 4, 5, 6.

Subfamily 2. *Cerophytides* Latreille.

CEROPHYTUM *Latr.* CERATOPHYTUM *Lea.* 1 sp. *Cer. elateroides* Latr.
Body ovoid; antennæ ♂ strongly pectinated; tarsal fourth joint bilobed. Guérin, Icon. Ins. pl. 12. f. 6.

THROSCUS *Latr.* TRIXAGUS *Gyll.* 2 sp. *Elat. dermestoides* Linn. Curt. 163.
Elliptic, depresssed; antennæ terminated by a 3-jointed perfoliated club; palpi clavate; fourth tarsal joint triangular.

Family 3. *ELATERIDÆ* Leach. (Elater *Linn.*)

ADRASTUS *Esch.* CATAPHAGUS A. p. *Steph.* 2 sp. *El. limbatus* Fab.
Plates at the base of the hind legs gradually dilated within; the sides of the thorax acutely marginate in the middle; body nearly linear; ungues denticulated. Herbst. Col. pl. 165. f. 11.

DALOPIUS *Esch.* CATAPHAGUS A. p. *Steph.* 1 sp. *El. marginatus* Linn.
Basal plates abruptly dilated within; sides of thorax acutely margined in the middle; antennæ serrate; body more robust. Oliv. 31. pl. 8. f. 83.

AGRIOTES *Esch.* CATAPHAGUS A. *Steph.* 4 sp. *El. sputator* Linn.
Antennæ submoniliform, second joint long; sides of thorax not acutely margined in the middle; forehead and thorax very convex; body oblong. Pz. 93. 13.

SERICOSOMUS *Serv.* SERICUS *Esch.* 4 sp. *El. brunneus* Linn.
Antennæ short, serrate, second and third joints short; basal plates broad, equal; body more or less cylindric; thorax short, convex. Herbst. 112. 27. b.

ECTINUS *Esch.* ELATER A. a. p. *Steph.* 1 sp. *El. aterrimus* * Linn.
Antennæ elongate; basal plates rather broader within; body very convex; fourth

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* Eschscholtz gives the Elater aterrimus *Fab.* as the type of his Ectinus, but Dejean and Latreille place the Aterrimus *Linn.* in this genus, giving the former insect, which is distinct, and is the Niger of *Linn.*, in the genus Athous. Mr. Stephens has also adopted this arrangement.

antennal joint longer than the fifth, the eleventh short and broad. Herbst. pl. 161. f. 11.

LIMONIUS *Esch.* ELATER A. b. c. *Steph.* 7 sp. *El. Bructeri* Fab. Pz. 34. 13.
Frontal carina distinct; basal joint of tarsus rather shorter than second; second and third antennal joints very minute; body oblong, subcylindric; thorax elongate, convex.

ELATER *Linn., Esch., Latr., Steph.* (p.) 9 sp. *El. sanguineus* Linn.
Basal plates suddenly dilated within, and toothed in the middle; tarsi setose, the joints gradually smaller; frontal carina distinct; body depressed; sides of thorax not dilated. Don. pl. 508. f. 2.

PROSTERNON *Latr.* ELATER B. 2.* *Steph.* 1 sp. *El. holosericeus* Fab.
Body suboval, subdepressed, very pubescent; thorax dilated at the sides; antennæ with the second and third joints not dilated, and smaller than the fourth; claws simple. Herbst. Col. 161. f. 9.

AGRYPNUS *Esch.* ELATER B. 2.** *Steph.* 3 sp. *El. murinus* Linn.
Body suboval, subdepressed, very pubescent; thorax dilated at the sides; antennæ with the second joint dilated, the first large; tarsi without soles; posterior margin of thorax with a central tubercle. Herbst. 161. f. 8.

HYPNOIDUS *Dillw. St.* { HYPOLITHUS *Esch.* / CRYPTOHYPNUS *Esch.* } 6 sp. *El. riparius* Fab.
Frontal carina distinct; palpi broad, securiform; scutellum broad; antennæ thick, subperfoliate, with the second and third joints almost as large as the others. Pz. 34. 12.

DRASTERIUS *Esch.* SELATOSOMUS p. *Steph.* 1 sp. *El. 2-maculatus* Fab.
Palpi acuminate; tibiæ externally, with long ciliæ; posterior trochanters suddenly dilated within; frontal carina distinct. Pz. 76. 9.

MELANOTUS *Esch.* PERIMECUS *St.* 1 sp. *El. fulvipes* Hbst. Hbst. 46. 162. 2.
Antennæ serrated, with the second and third joints short, the eleventh long, slender; body attenuated behind; posterior thoracic angles large; tarsi slender, simple; claws serrated.

LUDIUS *Latr.* STEATODERUS *Esch.* 1 sp. *El. ferrugineus* Linn. Don. 356. 1.
Antennæ strongly serrated; the second and third joints very small, eleventh abruptly attenuated at the tip; posterior trochanters spined within.

CTENICERUS *Latr.* CORYMBITES *Latr.* (*Ann.*) 7 sp. *El. pectinicornis* Linn.
Antennæ ♂ often strongly pectinated, with the second joint minute; labrum transverse; posterior trochanters narrow, lanceolate; frontal carina wanting. Donov. 356. 2.

SELATOSOMUS *Steph.* DIACANTHUS *Latr.* (*Ann.*) 2 sp. *El. æneus* Linn.
Body broad, glabrous; antennæ short, serrated, with obconic joints, the third as large as the following; tarsi simple, without soles; thorax gibbous. Donov. 535. f. 1, 2.

CARDIOPHORUS *Esch.* CALODERUS *Steph.* 3 sp. *El. thoracicus* Fab.
Scutellum cordate; posterior femora thicker than the others; tarsi slender, simple; thorax immarginate, very gibbous; third joint of antennæ as large as the fourth. Pz. 6. 12.

ATHOUS *Esch.* ANATHROTUS *Steph.* 10 sp. *El. vittatus* Fab. Don. 518. 2.
Frontal carina distinct; basal joint of tarsi as long as the two following, united, the third joint triangularly dilated, spongy; labrum narrow, transverse; palpi short, slender.

CTENONYCHUS *Steph. Dej.* MELANOTUS p. ? *Esch.* 1 sp. *Ct. hirsutus* Steph.
Claws toothed; third tarsal joint bilobed, spongy beneath, the two basal joints dilated; antennæ not compresed, second joint small; elytra with long hairs.

APLOTARSUS *Steph.* CARDIOPHORUS p. ? *Esch.* 4 sp. *El. rufipes* Fab.
Claws simple; palpi filiform; thorax elongate, subconvex; tarsi simple, fourth joint not minute; antennæ subserrated, second joint very minute, third joint as large as fourth. Panz. 93. 14.

CAMPYLIS *Fisch.* EXOPTHALMUS *Latr. olim.* 1 sp. *El. linearis* Linn.
Eyes very large, prominent; head exserted; body linear; antennæ long; tarsi simple; claws simple; prosternum not advanced over the mouth. Pz. 8. 11.

Stirps 2. *Aprosterni* Westw. (Malacodermi *Latr.*)

Family 1. *CEBRIONIDÆ* Leach.

ATOPA *Payk.* DASCILLUS *Latr.* 1 sp. *Chrysom. cervina* Linn. Curt. pl. 272.
Body oval; antennæ simple; basal tarsal joints cordate; pulvilli wanting.

Family 2. *CYPHONIDÆ* Stephens.

SCIRTES *Illiger.* ALTICA p. *Panz.* 2 sp. *Chrys. hæmispherica* Linn.
Body hemispheric; posterior femora thickened, formed forleaping. Pz. 96. 7.

CYPHON *Payk.* ELODES *Latr.* 16 sp. *Cyph. pallidus* Fab. Curt. 602.
Body oval; fourth tarsal joint bilobed; hind legs simple.

EUBRIA *Zeigl.* CYPHON p. *Germ.* 1 sp. *C. palustris* Germ. My f. 25. 18.
Body hemispheric; hind legs simple; tarsi filiform.

Family 3. *LAMPYRIDÆ* Leach. (Lampyris *Linn.*)

LAMPYRIS *Linn. and all authors.* 1 sp. *L. noctiluca* Sam. Comp. pl. 3. f. 1, 2.
Head not rostrated, covered by thorax; females apterous; mandibles entire.

DRILUS *Oliv.* COCHLEOCTONUS *Meilz.* ♀ 1 sp. *Dr. flavescens* Ol.
Head not rostrated, exserted; females apterous; mandibles bidentate. Oliv. 2. 4. pl. 1. f. 1.

DICTYOPTERA *Latr.* LYCUS *Steph.* 1 sp. *L. minutus* Fab. Curt. 263.
Head short; females winged; mandibles entire.

Family 4. *TELEPHORIDÆ* Leach. (Cantharis p. *Linn.*)

TELEPHORUS *De Geer.* CANTHARIS p. *Linn.* 34 sp. *Canth. fusca* Linn.
Elytra covering the abdomen; thorax entire. Curt. 215.

SILIS *Megerle.* TELEPHORUS p. *Steph.* 1 sp. *Canth. ruficollis* Fab.
Elytra covering the abdomen; thorax with the posterior margins notched, the sides straight. Charpent. Horæ Ent.

PODABRUS *Fisch.* TELEPHORUS p. *Steph.* 1 sp. *Canth. alpinus.*
Elytra covering the abdomen; thorax entire, rounded at the sides, emarginate in front; claws notched.

(RAGONYCHA *Esch.* (Bull. Mosc.) 2 sp. (claws notched). *Canth. melanurus, &c.*)

MALTHINUS *Latr.* NECYDALIS p. *Geoff.* 19 sp. *Canth. biguttata* Linn.
Elytra shorter than the abdomen. Oliv. 2. pl. 1. f. 6.

Family 5. *MELYRIDÆ* Leach.

MALACHIUS *Fab.* CANTHARIS p. *Linn.* 17 sp. *Canth. bipustulata* Linn.
Palpi filiform, narrowed at tip; thorax and abdomen with vesicles. Curt. 167.

DASYTES *Payk.* DERMESTES p. *Linn.* 6 sp. *D. cæruleus* Fab.
Body narrow; antennæ as long as the head and thorax; palpi thickened at the tips. Panz. F. I. G. 96. 10.

ENICOPUS *Steph.* DASYTES p. *Auct.* 1 sp. *Dermestes hirtus* Linn.
Anterior and posterior tarsi with a long curved basal horn; posterior tibiæ curved. Oliv. 2. 9. pl. 2.

DOLICHOSOMA *Steph.* DASYTES p. *Auct.* 1 sp. *Tillus filiformis* Fab.
Body very slender and elongate; elytra acute, squamose. Steph. 8. pl. 19. f. 5.

APLOCNEMUS *Steph.** ELICOPIS *Besser.* 2 sp. *Hispa. 4-pustul.* Fab.
Antennæ short, internally serrated; body obtuse, oblong; legs short. Oliv. 2. 10. pl. 1.

Family 6. *CLERIDÆ* Westw. (Tillidæ *Leach.*)

TILLUS *Oliv.* CHRYSOMELA p. *Linn.* 2 sp. *Chrys. elongata* Linn.
Antennæ subfiliform, serrated; thorax cylindric. Oliv. 11. 4. pl. 1. f. 1.

TILLOIDEA *Laporte.* TILLUS p. *Steph.* 1 sp. *Till. unifasciatus* Oliv.
Antennæ subfiliform, serrated; thorax obcordate; elytra convex. Curt. pl. 267.

OPILUS *Latr.* { EUPOCUS *Ill.* / NOTOXUS *Dej.* } 2 sp. *Attel. mollis* Linn. Curt. pl. 270.
All the palpi terminated by a hatchet-shaped joint; antennæ clavate.

THANASIMUS *Latr.* CLERUS *Dej.* 1 sp. *Attel. formicarius* Linn.
Antennæ gradually clavate; max. palpi small; labial palpi terminated by a large hatchet-shaped joint; basal tarsal joint small. Curt. pl. 398.

CLERUS *Geoff.* TRICHODES *Fab.* 2 sp. *Attel. apiarius* Hbst. Curt. 44.
Tarsi with the basal joint scarcely visible; labial palpi terminated by a large hatched-shaped joint; terminal joint of antennæ produced acutely within. Steph. Mand. vol. iii. pl. 19. f. 5.

NECROBIA *Oliv.* CORYNETES p. *Dej.* 4 sp. *Cor. rufico'lis* Fab.
Antennæ with the last joint the largest, square, internally obtuse; palpi subcylindric; ungues entire. Curt. pl. 350.

CORYNETES *Payk.* DERMESTES p. *Linn.* 1 sp. *Derm. violaceus* Linn.
Antennæ with the last three joints equal, the last internally acuminate; palpi with the last joint thickened, obconic; tarsal claws with a small basal tooth. Curt. pl. 351.

Family 7. *PTINIDÆ* Leach. (Ptinus *Linn.*)

Subfamily 1. *Ptinides* Westw.

Antennæ moderately long; three terminal joints similar to the preceding.

PTINUS *Linn. and all authors.* 8 sp. *Pt. fur.* Linn. Curt. 646.
Antennæ long, slender, and simple, inserted close together; eyes rather prominent; elytra separated; body oblong.

MEZIUM *Leach.* PTINUS p. *Marsh.* 1 sp. *Ptinus sulcatus* Fab. Curt. 232.
Antennæ subcompressed; elytra subglobose, polished; wings 0; thorax with longitudinal furrows.

GIBBIUM *Kugell.* SCOTIAS *Czemsp.* 1 sp. *Ptinus Scotias* Fab. Curt. 342.
Antennæ subcompressed; elytra subglobose, polished; wings 0; thorax smooth.

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* Mr. Stephens has introduced into this genus a third species under the name of (Aploc?) floralis *Oliv.*? upon the authority of an insect captured by me near Petworth, which, however, I have ascertained to be Dasytes niger *Linn.*

PTILINUS *Fab.* ANOBIUM p. *Illiger.* 2 sp. *Ptin. pectinicornis* Linn.
Body cylindric; antennæ ♂ strongly pectinated. Don. pl. 320.

XYLETINUS *Latr.* SERROCERUS *Kug.* 2 sp. *Ptilin. pectinatus* Fab.
Body broadly ovate; antennæ in both sexes strongly serrated; elytra striated; palpi with the last joint securiform. Curt. 375.

OCHINA *Zeigl.* CRIOCERIS p. *Marsh.* 1 sp. *Crioc. Ptinoides* Marsh.
Antennæ slightly serrated; elytra soft, smooth, subovate; palpi simple.

LASIODERMA *Steph. Ill. 5.* 417. 1 sp. *Ins. testaceum* Steph.
Antennæ with the basal joint large, robust, the third to the tenth serrated; head broad; thorax broad, semicircular; elytra soft, smooth, broad, oblong.

Subfamily 2. *Anobiides* Westw.
Antennæ with the last three joints distinctly larger than the preceding.

DORCATOMA *Herbst.* SERROCERUS p. *Kug.* 3 sp. *D. Dresdensis* Hbst.
Antennæ with the last three joints triangular and flattened; body short, but globose; palpi securiform. Hbst. pl. 39. f. 8.

ANOBIUM *Fab.* PTINUS p. *Linn.* 11 sp. *Pt. pertinax Linn.* Curt. 387.
Body oblong-ovate; antennæ with the ninth and tenth joints subconical, and much thicker than the preceding; terminal joint ovate; palpi simple.

DRYOPHILUS *Chevrolat. Steph. Ill. 5.* 418. 1 sp. *Dr. anobioides* Chevr.
Body subcylindric; antennæ ♂ with the three terminal joints very long and slender; eyes prominent. Guér. Mag. Zool. Ins. pl. 3.

Family 8. *LYMEXYLONIDÆ* Steph. (Xylotrogi *Latr.*)

LYMEXYLON *Fab.* PTEROPHORUS *Herbst.* 1 sp. *Cantharis navalis* Linn.
Body long, linear, depressed; head vertical; elytra nearly covering the abdomen; antennæ simple. Curt. pl. 382.

HYLECŒTUS *Latr.* CANTHARIS p. *Linn.* 1 sp. *Canth. dermestoides* L.
Antennæ compressed, serrated; thorax square; body subconvex; elytra covering the abdomen. Curt. 654.

Family 9. *BOSTRICHIDÆ* Westw.

BOSTRICHUS *Geoff.* nec *Erichs.* APATE *Fab.* 1 sp. *Derm. capucinus* Linn.
Elytra entire, rounded at the apex; antennæ with the second joint short, subclavate; terminal joints not laminate nor transverse. Curt. 271.

APATE *Fab.* BOSTRICHUS p. *Oliv.* 1 sp. *Ap. sinuata* Fab.
Elytra posteriorly retuse; antennæ with the second joint elongate, cylindric; terminal joints forming a perfoliated club. Steph. Ill. 3. pl. 19. f. 6.

(SINOXYLON *Duf.* BOSTRICHUS p. *Oliv.* 1 sp. *B. bispinosa* Oliv.
Elytra posteriorly retuse and spinose; antennæ with the terminal joints sublaminated; tibiæ simple. Oliv. 4. pl. 4. f. 1.)

DINODERUS *Steph.* APATE p. *Payk.* 1 sp. *Ap. substriata* Pk.?
Elytra posteriorly retuse; antennæ with the second joint subglobose; the terminal joints perfoliated; tibiæ denticulated.

RHYZOPERTHA *Steph.* PTINUS p. *Marsh.* 2 sp. *Pt. piceus* M.
Elytra elongate, posteriorly rounded; antennæ with the terminal joints sublaminated; tibiæ serrated.

CIS *Latr.* PTINUS p. *Marsh.* 13 sp. *Anobium Boleti* Fab. Curt. 402.
Cylindric, ovate; thorax rounded at the sides, dilated in front; tarsi 4-jointed; three basal joints very short; antennæ 10-jointed, with the last three joints

forming a club; head in the males often tubercular; mandibles bidentate; maxillary palpi with the last joint large and oval.

Family 10. *SCYDMÆNIDÆ* Steph.

SCYDMÆNUS *Latr.* ANTHICUS p. *Fab.* 16 sp. *Sc. Hellwigii* Latr.
Elytra separated; antennæ thickened at the tips; the basal joints but little thicker and longer than the rest. Denny, Mong. pl. 11.

Sect. II. HETEROMERA *Latreille.*

Tribe 1. *Trachelia* Westw.

Family 1. *NOTOXIDÆ* Steph.

NOTOXUS *Ill.* MELOE p. *Linn.* 2 sp. *Not. monoceros* Linn.
Thorax produced over the head into a horn; neck distinct. Steph. pl. 25. f. 5.

ANTHICUS *Fab.* MELOE p. *Linn.* 8 sp. *A. antherinus* Linn. Panz. 11. 14.
Thorax not cornuted in front; neck distinct.

Family 2. *PYROCHROIDÆ* Leach.

PYROCHROA *Fab.* CANTHARIS p. *Linn.* 2 sp. *Ca. coccinea* Linn. Curt. 590.
Antennæ rather longer than the head and thorax, pectinated in ♂; eyes ♂ distant.

Family 3. *LAGRIIDÆ* Westw. (Lagriariæ *Latr.*)

LAGRIA *Fab.* CHRYSOMELA p. *Linn.* 1 sp. *Ch. hirta* Linn. Curt. 598.
Thorax cylindric, much narrower than the elytra; ♂ antennæ with the last joint long.

Family 4. *HORIIDÆ* Westw. (Horiales *Latr.*)
There is no British species of this family.

Family 5. *MORDELLIDÆ* Leach. (Mordella *Linn.*).

MORDELLA *Linn.* ——— 9 sp. *M. aculeata* Linn. Curt. 483.
Abdomen styliferous; scutellum distinct; tarsi simple.

ANASPIS *Geoff.* MORDELLA p. *Linn.* 18 sp. *M. frontalis* Linn. Pz. 13. 13.
Abdomen not styliferous; scutellum distinct; penultimate joint of anterior tarsi bilobed.

RIPIPHORUS *Fab.* MORDELLA p. *Linn.* 1 sp. *M. paradoxus* Linn.
Scutellum hidden; antennæ ♂ pectinated. Curt. 19.

Family 6. *CANTHARIDÆ* Leach. (Meloe *Linn.*)

CANTHARIS *Geoff.* LYTTA *Fab.* 1 sp. *Mel. vesicatoria* Linn. Curt. 658.
Narrow; wings two; elytra elongate; last joint of max. palpi subovate.

SYBARIS *Steph.* ——— 1 sp. *Syb. immunis* Steph. Steph. 5. pl. 25. f. 4.
Narrow; elytra elongate; thorax broadest behind; last joint of max. palpi securiform.

SITARIS *Latr.* NECYDALIS p. *Fab.* 1 sp. *Nec. humeralis* Fab. Curt. 340.
Elytra attenuated, not lapping over each other; wings two; antennæ simple.

MELOE *Linn. &c.* PROSCARABÆUS *Steph.* 9 sp. *Mel. proscarabæus* Linn.
Wings 0; elytra short, lapping over each other within; antennæ various. Curt. 279.

Family 7. *SALPINGIDÆ* Leach.

SALPINGUS *Ill.* RHINOSIMUS *Latr.* 4 sp. *Cur. ruficollis* Linn. Pz. 24. 19.
Oblong-ovate, depressed; rostrum elongate; club of antennæ 5-jointed; head depressed.

SPHÆRIESTES *Kirby.* SALPINGUS p. *Gyll.* 7 sp. *Salp. ater* Gyll. Curt. 662.
Oblong-ovate, glabrous; rostrum short; club of antennæ 5-jointed; head subconvex.

MYCTERUS *Clairv.* RHINOMACER p. *Fabr.* 1 sp. *Myct. griseus* Clv.
Ovate, sericeous; rostrum elongate; antennæ filiform. Steph. 4. pl. 21. f. 4.

Family 8. *ŒDEMERIDÆ* Leach.

ŒDEMERA *Oliv.* NECYDALIS p. *Linn.* 2 sp. *Nec. cærulea* Linn. Don. 558.
Elytra subulate; posterior femora ♂ incrassated.

ONCOMERA *Steph.* ŒDEMERA p. *Auct.* ? 1 sp. *Nec. podagrariæ* Linn.
Elytra not subulate; posterior femora ♂ incrassated; thorax oblong. Oliv. 3. 10. pl. 1.

ISCHNOMERA *Steph.* ŒDEMERA p. *Auct.* 5 sp. *Nec. cærulea* Linn.
Elongate; elytra not subulate; posterior femora simple. Curt. fig. 390.

NOTHUS *Zeigl.* OSPHYA *Illig.* 2 sp. *N. clavipes* Illig. Curt. 538.
Thorax orbiculate, depressed, margined; hind femora ♂ incrassated.

CONOPALPUS *Gyll.* ZONITIS *Curt.* 2 sp. *Mel. testacea* Oliv. Curt. 112.
Antennæ 10-jointed; thorax transverse, orbicular; last joint of palpi large, securiform.

ENGLENES *Westw.* XYLOPHILUS p. *Bon.* 1 sp. *Anth. oculatus* Pk.
Antennæ ♂ very long; eyes ♂ very large; palpi securiform; penult. tarsal joint minute. Curt. pl. 299.

ADERUS *Westw.* XYLOPHILUS p. *Bon.* 1 sp. *Lytta Boleti* Marsh. *
Ovate; antennæ 11-jointed, moderately long, second and third joints minute; eyes moderate, entire. Steph. pl. 25. 6.

Family 9. *MELANDRYIDÆ* Leach.

MELANDRYA *Fab.* SERROPALPUS p. *Illig.* 2 sp. *Chrys. caraboides* Linn.
Elongate-ovate, subdepressed, narrowed in front; max. palpi large, 4-jointed, serrated, last joint large, ovate, fleshy on the inner margin. Curt. 155.

PHLOIOTRYA *Steph.* XYLITA p. *MacL.* 1 sp. *Serr. rufipes* Gyll.
Oblong, convex, orbicular in front, sinuated behind; maxillæ elongate, deflexed. Steph. pl. 24. f. 4.

DIRCÆA *Fab.* SERROPALPUS p. *Latr.* 1 sp. *D. variegata* Fab.
Oblong, convex; antennæ slightly thickened at the tips; last joint of max. palpi securiform. Act. N. H. Par. 1. pl. 10.

HYPULUS *Payk.* SERROPALPUS p. *Illig.* 1 sp. *H. quercinus* Pk.
Elongate, subconvex; antennæ subfiliform; thorax elongate, narrowed behind. Steph. pl. 24. f. 5.

ABDERA *Steph.* HYPULUS p. *Curt.* 3 sp. *Mord. bifasciata* Marsh.
Elongate, ovate; antennæ rather thicker at the tips; thorax broadest behind. Curt. fig. 255.

SCRAPTIA *Latr.* DIRCÆA p. *Sch.* 2 sp. *Sc. fusca* Latr. Steph. pl. 24. f. 3.
Thorax suborbicular; labial palpi with the last joint obtrigonate; antennæ filiform.

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* The Xylophilus populneus of Curtis is certainly identical with this insect. The pygmæus of Degeer is also identical with the oculatus.

HALLOMENUS *Hellw.* DIRCÆA *Fab.* 3 sp. *H. flexuosus* Pk. Curt. 474.
Oblong-ovate, subdepressed; thorax broad behind; last joint of labial palpi minute; tarsi entire.

ORCHESIA *Latr.* HALLOMENUS p. *Pk.* 3 sp. *Orch. micans* Latr. Curt. 197.
Elongate-ovate, convex; posterior tibiæ with two long spurs; antennæ clavate.

Tribe 2. *Atrachelia* Westw.

Subtribe. 1. *Varicolores* Westw.

Family 1. *CISTELIDÆ* Leach. (Xystropides *Solier.*)

ERYX *Steph.* PRIONYCHUS *Solier.* 1 sp. *Pyrochr. nigra* De Geer. Pz. 50.3.
Broadly ovate; mandibles bifid; max. palpi obliquely truncate; tarsi pulvillate.

MYCETOCHARUS *Latr.* MYCETOPHILA *Gyll.* 1 sp. *M. scapularis* Gyll.
Narrow, linear, elongate; tarsi not pulvillate; mandibles bifid; max. palpi strongly securiform. Pz. 25. 14.

CISTELA *Fab.* CHRYSOMELA p. *Linn.* 6 sp. *Ch. ceramboides* Linn.
Ovate; thorax semicircular; mandibles bifid; max. palpi subsecuriform. Curt. 594.

OMOPHLUS *Meg.* CISTELA *Fab.* 1 sp. *Om. Armeriæ* Curt. Curt. 622.
Thorax broadest in front; mandibles acute at the tips; max. palpi clavate, scarcely securiform; elytra elliptical.

MEGISCHIA *Solier.* CISTELA p. *Steph.* 1 sp. *Cist. curvipes* Dej.
Palpi filiform, terminal joint scarcely enlarged; mandibles entire.

CTENIOPUS *Solier.* ALLECULA *Steph.* 1 sp. *Chr. sulphurea* Linn. Pz. 106. 8.
Thorax subquadrate, narrowed slightly behind; mandibles entire; eyes prominent.

Family 2. *HELOPIDÆ* Stephens.

HELOPS *Fab.* TENEBRIO p. *Linn.* 4 sp. *H. caraboides* Pz. Curt. 298.
Oblong-ovate; antennæ subfiliform; thorax subquadrate, or subcordate.

Family 3. *DIAPERIDÆ* Stephens.

DIAPERIS *Geoff.* CHRYSOMELA p. *Linn.* 1 sp. *Chr. Boleti* Linn. Curt. 358.
Subrotundate, convex; antennæ with the fourth and following joints lenticular; palpi filiform.

PLATYDEMA *Lap. and Br.* DIAPERIS p. *Steph.* 4 sp. *D. violacea* Fab.
Ovate, subconvex; fourth and following joints of antennæ conical; max. palpi with the last joint enlarged. Panz. 94. 9.

PHALERIA *Latr.* TENEBRIO p. *Fab.* 1 sp. *Ten. cadaverina* Fab.
Ovate; antennæ perfoliated; tibiæ triangular, spinose; max. palpi with the last joint obtrigonate. Sturm. D. F. 2. 47. A.

ALPHITOPHAGUS *Steph.* PHYLITHUS *Megerle?* 1 sp. *Alph. 4-pustulatus* St.
Oval, convex; antennæ slightly clavate; tibiæ simple; last joint of palpi subincrassated. Steph. 24. f. 1.

BOLITOPHAGUS *Fab.* ELEDONA *Latr.* 1 sp. *Bol. agricola* F., Curt. 586.
Obtuse, ovate, convex; thorax crenated; antennæ clubbed and serrated.

HYPOPHLÆUS *Fab.* IPS p. *Oliv.* 3 sp. *H. bicolor* Fab. Curt. 430.
Elongate, subdepressed; elytra linear; antennæ short, gradually thickened and serrated.

TRACHYSCELIS *Latr.* ——— 1 sp. *Tr. aphodioides* Latr.
Broadly ovate; tibiæ dilated, spinose, the anterior serrated; club of antennæ 6-jointed. Guérin. Icon. R. An.

Subtribe 2. *Melasomata* Latreille.

Family 4 (or 1.). *TENEBRIONIDÆ* Leach. (Tenebrio *Linn.*)

TENEBRIO *Linn., &c.* ——— 4 sp. *T. molitor* Linn. Curt. 331.
Narrow, elongate; thorax quadrate; antennæ filiform.

ULOMA *Meg.* ULOSA *Meg.* 2 sp. *Trogos. cornuta* Fab. Latr. Gen. pl. 10.
Oblong-ovate, depressed; antennæ clavate, third joint as large as the fourth; mandibles ♂ large.

ALPHITOBIUS *Steph.* ULOMA p. *Curt.* 2 sp. *Ten. Fagi* Panz. Curt. 363.
Oblong-ovate; antennæ clavate, third joint much longer than fourth.

STENE *Kirby.* TENEBRIO p. *Oliv.* 1 sp. *Ten. ferrugineus* Ol.
Elongate, depressed; antennæ clavate, third joint short. Oliv. 3. 18. pl. 2.

SARROTRIUM *Illig.* ORTHOCERUS *Latr.* 1 sp. *Hisp. mutica* Linn. Curt. 314.
Elongate, subconvex; antennæ thick and very pilose.

OPATRUM *Fab.* SILPHA *Linn.* 2 sp. *Silpha sabulosa* Linn. Curt. 319.
Oblong-ovate, subconvex; antennæ thickened at the tips; wings two.

HELIOPHILUS *Dej.* TENEBRIO p. *Marsh.* 2 sp. *Ten. obsoletus* Marsh.
Ovate, subconvex; antennæ thickened at the tips; elytra connate; wings 0. Steph. pl. 24.

PEDINUS *Latr.* BLAPS p *Fab.* 1 sp. *Bl. femoralis* Fab. Panz. 39. 5. 6.
Ovate; antennæ filiform, terminal joints longer than broad; wings 0.

PHYLAN *Meg.* TENEBRIO p. *Marsh.* 1 sp. *Opatr. gibbum* Fab.
Ovate; antennæ filiform; terminal joints broader than long; wings 0. Herbst. 7. 112. 3.

CRYPTICUS *Latr.* BLAPS p. *Fab.* 1 sp. *Bl. glaber* Fab. Panz. 36. 1.
Ovate; antennæ filiform; elytra not connate; wings two.

Family 5 (or 2.). *BLAPSIDÆ* Stephens.

BLAPS *Fab.* TENEBRIO p. *Linn.* 3 sp. *T. mortisaga* Linn. Curt. 148.
Oblong-ovate, flat above; margins of elytra inflexed; wings 0.

Family 6 (or 3.). *PIMELIIDÆ.*

(There is no British species of this family.)

Sect. III. PSEUDOTETRAMERA *Westw.* (Tetramera *Latr.*)

Stirps 1. *Rhyncophora* Latr.

Family 1. *BRUCHIDÆ* Leach. (Bruchus *Linn.*)

Subfamily 1. *Bruchides* Westw.

BRUCHUS *Linn.* MYLABRIS *Geoffr.* 7 sp. *Br. granaria* L. Pz. 66. 11.
Antennæ filiform, or slightly and gradually thickened to the tips, often serrated; elytra oblong-quadrate.

Subfamily 2. *Anthribides* Westw.

BRACHYTARSUS *Sch.* PAROPES *Meg.* 2 sp. *Anthr. scabrosus* F.
Short, ovate; eyes entire; antennæ abruptly clavate. Pz. 15. f. 15.

PHLOEOBIUS *Sch.* ANTHRIBUS p. *Fab.* 1 sp. *An. griseus* Fab.
Ovate; eyes emarginate; antennæ slender, elongated. Steph. pl. 21. f. 2.

TROPIDERES *Sch.* MACROCEPHALUS p. *Oliv.* 2 sp. *An. albirostris* F.
Oblong; eyes entire; two basal joints of antennæ elongated. Pz. 15. 13.

PLATYRHINUS *Clv.* MACROCEPHALUS p. *Oliv.* 1 sp. *Curc. latirostris* Bons.
Oblong; eyes entire; two basal joints of antennæ short; club abrupt. Don. 348. 1.

ANTHRIBUS *Fab.* MACROCEPHALUS p. *Oliv.* 1 sp. *Curc. albinus* Linn.
Oblong; eyes emarginate; antennæ ♂ elongated; club narrow. Don. 348. 3.

RHINOMACER *Fab.* ANTHRIBUS p. *Oliv.* 1 sp. *Rh. attelaboides* F.
Rostrum elongate, dilated at the tip; club of antennæ slender. Steph. 21. f. 3.

CHORAGUS *Kirby.* ANTHRIBUS *Robert.* 2 sp. *Ch. Sheppardi* K.
Saltatorial, short, ovate; antennæ long; club 3-jointed; head scarcely rostrated. Kirby, L. T. 12. 22. 14.

Family 2. *ATTELABIDÆ* Westw.

Subfamily 1. *Brenthides* Westw.

(There is no British species of this subfamily.)

Subfamily 2. *Attelabides* Westw. (Attelabus p. *Linn.*)

APODERUS *Oliv.* ATTELABUS p. *Fab.* 1 sp. *Att. avellanæ* Linn.
Antennæ 12-jointed; head narrowed behind into a neck; thorax narrowed in front. Clv. 1. pl. 15.

ATTELABUS *Linn.* CYPHUS *Thunb.* 1 sp. *Att. curculionoides* Linn.
Broad; elytra subquadrate; antennæ 11-jointed; head not narrowed behind the eyes. Curtis 710.

RHYNCHITES *Herbst.* RHINOMACER p. *Geoff.* 21 sp. *Curc. Bacchus* Linn.
Antennæ 11-jointed; head with a thick neck; rostrum dilated at the tip; thorax conic-cylindric. Curtis 642.

DEPORAUS *Leach.* RHYNCHITES p. *Sch.* 1 sp. *Att. Betulæ* Linn.
Rostrum short, dilated at the tip; basal joints of antennæ short, robust; posterior femora ♂ thickened. Panz. 20. 15.

RAMPHUS *Clv.* RYNCHÆNUS p. *Gyll.* 1 sp. *Rh. flavicornis* Clv.
Rostrum elongate, filiform and incurved; antennæ short; hind legs formed for leaping. Clv. 1. pl. 12.

OXYSTOMA *Dum.* APION p. *Kirby.* 3 sp. *Ap. ulicis* K.
Oblong, convex, very pubescent; rostrum elongated, deflexed; antennæ basal. Linn. Tr. 9. pl. 1. f. 1.

APION *Herbst.* APIUS *Billb.* 93 sp. *Curc. frumentarius* L. Curt. 211.
Pear-shaped; rostrum porrect; antennæ basal or medial.

Family 3. *CURCULIONIDÆ* * Leach, (Curculio *Linn.* Gonatoceri *Schonh.*)

Legion 1. *Brachyrhynchi* Sch.

Division 4. *Brachyderides* Sch.

STROPHOSOMUS *Billberg.* BRYSSUS *Meg.* 16 sp. *Curc. Coryli* Fab.
Apterous; rostrum short, thick; eyes very prominent; third joint of antennæ longer than the second. Panz. 19. 12.

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* *Obs.* — In the Synopsis of the genera of this family I have adopted the distribution of Schonherr's great work, omitting those divisions (Brachycerides, Entimides, &c.) of which there are no British representatives, but retaining the numbers of Schonherr's divisions.

CNEORHINUS *Sch.* PHILOPEDON *Sch. ol.* 4 sp. *Curc. exaratus* Marsh.
Rostrum very short, thick; elytra very convex, rounded; tibiæ unarmed; third joint of antennæ short. Donov. 414. 2.

SCIAPHILUS *Sch.* THYLACITES p. *Germ.* 3 sp. *Curc. muricatus* Fab.
Short, ovate, winged; eyes moderate; femora dentate; tibiæ unarmed at the tip. Hbst. 6. 87. 9.

(BRACHYDERES *Sch.* NAUPACTUS *Meg.* 1 sp. *Curc. incanus* Linn.
Rostrum very short, stout; elytra subovate; femora unarmed; antennæ 12-jointed.)

(RHYTIRHINUS *Sch.* BROTHEUS *Steph.* 1 sp. *Curc. porcatus* Marsh.
Antennæ scarcely elbowed; basal joint slightly elongate; elytra abruptly retuse.)

(CHLOROPHANUS *Dalm.* CHLORIMA *Dej.* 1 sp. *Curc. viridis* Linn.
Elytra large, ovate; legs elongate; rostrum short; antennæ not geniculated basal joint elongate. Panz. 107. 3.)

TANYMECUS *Germ.* CURCULIO p. *Fab.* 2 sp. *Curc. palliatus* Fab.
Elongate, ovate; elytra acuminated; fourth to eighth joints of antennæ subturbinated. Panz. 19. 5.

SITONA *Germ.* CURCULIO *Linn.* 24 sp. *Curc. lineatus* L. Donov. 389. 2.
Oblong, winged; rostrum short; antennæ with the third joint shorter than the second.

POLYDRUSUS *Germ.* NEMOICUS *Dillw.* 12 sp. *Curc. micans* Fab.
Oblong, squamose; antennæ with the second and third joints subequal; rostrum short. Curt. 278.

NEMOICUS *Dillw.* CURCULIO p. *Linn.* 1 sp. *Curc. oblongus* Linn.
Elongate, pilose; antennæ with the second and third joints subequal; wings two. Panz. 19. 15.

Division 5. *Cleonides* Sch.

CLEONUS *Sch.* LIXUS p. *Illig.* 4 sp. *Curc. sulcirostris* Linn. Don. 509. 1.
Elongate, convex; rostrum short, thick; antennæ apical; second joint of antennæ longer than the third.

BOTHYNODERES *Sch.* LIXUS p. *Oliv.* 1 sp. *Curc. albidus* Fab. Panz. 19. 7.
Elongate; rostrum longer than the head, carinated; second and third joints of antennæ nearly equal.

GRONOPS *Sch.* BAGOUS p. *Germ.* 1 sp. *Curc. lunatus* Fab.
Elytra rostrated; thorax deeply emarginate in front; tibiæ straight. Steph. Ill. 21. f. 1.

LIOPHLEUS *Germ.* GASTRODUS *Meg.* 2 sp. *Curc. nubilus* Fab.
Apterous, ovate, pubescent; rostrum as long as the head; elytra not emarginate in front. Panz. 106. 5.

MERIONUS *Meg.* BARYNOTUS p. *Sch.* 2 sp. *Curc. obscurus* Fab.
Oblong; rostrum and thorax canaliculate; elytra emarginate in front. Hbst. 7. 100. 3.

BARYNOTUS *Germ.* CURCULIO p. *Fab.* 1 sp. *Curc. mercurialis* Fab.
Ovate, apterous; rostrum and thorax carinate; elytra emarginate in front. Hbst. 6. 77. 3.

ALOPHUS *Sch.* LEPYRUS *Germ.* 3 sp. *Curc. triguttatus* Fab.
Oblong; rostrum twice as long as the head, thick; tibiæ not hooked. Donov. 414. 1.

Division 6. *Molytides Sch.*

TANYSPHYRUS *Germ.* Rhynchænus *Fab.* 1 sp. *Rh. Lemnæ* Fab.
Oblong-ovate, winged; second joint of antennæ short, thick; tibiæ with a strong apical hook. Panz. 17. 10.

HYLOBIUS *Germ.* Curculio p. *Linn.* 2 sp. *Curc. abietis* Linn. Donov. 529.
Oblong-ovate, winged; rostrum much longer than the head; second antennal joint elongate.

MOLYTES *Sch.* Liparus *Oliv.* 2 sp. *Curc. anglicanus* Mart. Don. 34. 2.
Broad, ovate, glabrous; tibæ with a strong apical hook; scutellum minute, wingless.

LEIOSOMA *Kirby.* Molytes p. *Sch.* 1 sp. *Curc. punctatus* Marsh.
Broad, ovate, apterous; elytra punctate, striate; scutellum minute; tibiæ hooked.

PLINTHUS *Germ.* Lixus p. *Fabr.* 1 sp. *Curc. caliginosus* Fab. Don. 570.
Elongate, apterous; scutellum none; tibiæ hooked; rostrum subcylindric.

HYPERA *Germ.* Phytonomus *Sch.* 29 sp. *Rhynch. fasciculosa* Gyll.
Oblong or ovate, squamose; tibiæ not hooked; rostrum deflexed, subcylindric. Curt. 116.

PROCAS *Steph.* Curculio p. *Marsh.* 2 sp. *Curc. picipes* M.
Oblong, not squamose; rostrum long, subclavate; legs and antennæ slender.

Division 8. *Phyllobides* Sch.

PHYLLOBIUS *Sch.* Curculio p. *Linn.* 12 sp. *Curc. Pyri* Linn.
Oblong-ovate, squamose; tibiæ rounded; rostrum short; second and third joints of antennæ elongate. Panz. 107. 4.

Division 9. *Cyclomides* Sch.

TRACHYPHLÆUS *Germ.* Curculio p. *Linn.* 7 sp. *C. scabriculus* Linn.
Short, ovate, setose or hispid; femora unarmed; tibiæ hooked; rostrum as long as the head, deflexed. Hbst. 6. 87. 10.

BRACHYSOMUS *Sch.* Curculio p. *Fab.* 1 sp. *Cur. hirsutulus* Fab.
Ovate, wingless; elytra subglobose; rostrum very short; antennæ 12-jointed. Pz. 7. 7.

Division 10. *Otiorhynchides* Sch.

OTIORHYNCHUS *Germ.* Pachygaster *Germ. ol.* 22 sp. *Cur. sulcatus* Fab.
Apterous, ovate, glabrous; rostrum laterally dilated beneath the insertion of the antennæ. Hbst. 6. 87. 5.

Legion 2. *Mecorhynchi* Sch.

Division 1. *Erirhinides* Sch.

LIXUS *Fab.* Leptosoma *Leach.* 5 sp. *Curc. paraplecticus* Linn. Curt. 542.
Oblong, narrow, subcylindric; rostrum elongate, nearly straight; tibiæ hooked.

LARINUS *Sch.* Curculio p. *Hbst.* 1 sp. *Curc. sturnus* Hbst.
Elytra broad, ovate; rostrum robust, shorter than the thorax; antennæ sub-basal. Hbst. 6. 68. 5.

RHINOBATUS *Meg.* Larinus p. *Germ.* 1 sp. *Curc. planus* Fab.
Ovate, subconvex; rostrum longer than the thorax, slender; femora unarmed; tibiæ minutely hooked. Don. 509. 2.

RHINOCYLLUS *Germ.* Rhinomacer *Leach.* 1 sp. *Curc. thaumaturgus* Ross.
Antennæ scarcely geniculated; rostrum short, thickened; antennæ subapical. Don. 512.

PISSODES *Germ.* PISOCLES *Dej.* 3 sp. *Curc. pini* Linn Pz. 42. 1.
Oblong-ovate; rostrum as long as the thorax; antennæ central, geniculated; femora unarmed; tibiæ hooked.

MAGDALIS *Germ.* THAMNOPHILUS *Sch.* 4 sp. *Curc. carbonarius* Linn.
Rostrum twice as long as the head, curved; antennæ 12-jointed, slightly geniculated; femora dentate. Curt. 212.

RHINODES *Dej.* MAGDALIS p. *Germ.* 2 sp. *Curc. pruni* Linn.
Rostrum as long as the head, nearly straight; femora simple; club of antennæ small; elytra subcylindric. Hbst. 6. 64. 6.

PANUS *Sch.* RHINA p. *Latr.* 1 sp. *Rh. barbicornis* Latr.
Rostrum as long as the head; club of antennæ very large; femora not toothed.

NOTARIS *Germ.* ERIRHINUS p. *Sch.* 4 sp. *Curc. acridulus* Linn. Pz. 42. 10.
Short, ovate; elytra oblong-ovate; femora not toothed; rostrum long, curved; antennæ sub-apical.

DORYTOMUS *Germ.* ERIRHINUS p. *Sch.* 12 sp. *Curc. vorax* Hbst.
Anterior legs long; femora dentate; tibiæ slightly hooked; elytra elongate. Panz. 18. 13.

ERIRHINUS *Sch.* p. NOTARIS p. *Germ.* 4 sp. *Curc. festucæ* Hbst.
Oblong; elytra not tubercled; second and third joints of antennæ longish; tibiæ curved. Curt. 634.

GRYPIDIUS *Sch.* GRYPUS *Germ.* 1 sp. *Rh. equiseti* Fab. Panz. 42. 4.
Subovate; elytra gibbose, tubercled, deflexed behind; scutellum small.

HYDRONOMUS *Sch.* BAGOUS p. *Germ.* 1 sp. *Curc. alismatis* Marsh.
Oblong, posteriorly attenuated; rostrum rather short; tibiæ curved, hooked; femora unarmed.

ELLESCUS *Meg.* PHYTONOMUS p. *Sch. ol.* 1 sp. *Curc. bipunctatus* Linn.
Elytra oblong-ovate; femora and tibiæ unarmed, the latter straight; rostrum rather longer than the head. Panz. 42. 7.

ANTHONOMUS *Germ.* PALLENE *Meg.* 10 sp. *Curc. pomorum* Linn.
Oblong-ovate, convex; tibiæ dilated in the middle; femora dentate. Curt. 562.

BALANINUS *Germ.* CURCULIO p. *Linn.* 11. sp. *Curc. nucum* Linn.
Rostrum nearly as long as the body, which is subtriangular; anterior tibiæ minutely hooked; antennæ inserted behind the middle of the rostrum. Steph. Ill. pl. 20. 4.

AMALUS *Sch.* CURCULIO p. *Hbst.* 1 sp. *Curc. scortillum* Hbst.
Elytra subovate, convex; antennæ 11-jointed; rostrum long, slender, not received in a pectoral groove; femora and tibiæ simple. Hbst. 6. 92. 13.

ANOPLUS *Sch.* RHYNCHÆNUS p. *Gyll.* 1 sp. *Rh. plantaris* Gyll.
Ungues wanting; rostrum not received in a pectoral groove.

TYCHIUS *Germ.* CURCULIO p. *Linn.* 11 sp. *Curc. 5-punctatus* Linn.
Ovate, subconvex, squamose; rostrum elongated; thorax globose; pectoral groove wanting. Steph. pl. 20. 3.

SIBYNES *Sch.* SIBINIA *Germ.* 3 sp. *Curc. primitus* Hbst. Hbst 6. 66. 8.
Pubescent; elytra short, broad, depressed; thorax posteriorly produced; femora unarmed; antennæ 11-jointed; funiculus 6-jointed.

ORCHESTES *Illig.* SALIUS *Germ.* 19 sp. *Curc. quercus* Linn. Curt. 678.
Hind femora incrassated; saltatorial; antennæ 11-jointed.

TACHYERGES *Sch.* ORCHESTES p. *Illig.* 7 sp. *Curc. salicis* Linn.
Hind legs saltatorial; antennæ 12-jointed. Donov. 121. 5—7.

ORTHOCHÆTES *Mull.* Styphlus? *Sch. ol.* 1 sp. *O. setiger* Germ.
Elytra oblong-ovate, connate, setose; wings 0; antennæ 12-jointed; femora and tibiæ unarmed.

Division 3. *Cryptorhynchides* Sch.

CRYPTORHYNCHUS *Illig.* Curculio p. *Linn.* *C. Lapathi* Linn.
Elytra tubercled; tibiæ bent at base; rostrum received in a pectoral groove; second, third, and fourth joints of antennæ elongate. Donov. 205. 1.

LYPRUS *Sch.* Lixus p. *Ahr.* 1 sp. *Rhynch. cylindrus* Gyll.
Elongate, subcylindric, compressed; a pectoral groove; antennæ 11-jointed; femora unarmed. Ahr. Act. Hal. 2. pl. 1. 9.

PACHYRHINUS *Kirby.* Hydaticus *Sch.* 6 sp. *Curc. comari* Hbst.
Elytra short, ovate; rostrum very short and thick; antennæ 11-jointed; pectoral groove wanting. Curt. 558.

BAGOUS *Germ.* Rhynchænus p. *Gyll.* 5 sp. *Curc. binodulus* Hbst.
Elytra oblong-ovate; antennæ short, slender; tibiæ long and bent; femora unarmed. Hbst. 6. 77. 15.

RUTIDOSOMA *Steph.* Acalles p. *Curt.* 1 sp. *Curc. globulus* Hbst.
Elytra globose, moveable; thorax short; femora dentate; tibiæ hooked; antennæ 12-jointed. Hbst. 6. 91. 7.

ACALLES *Sch.* Curculio p. *Marsh.* 2 sp. *C. ptinoides* M. Curt. 550.
Elytra connate, subgibbose; thorax rather long; tibiæ hooked.

NEDYUS *Sch. olim.* Falciger *Meg.* 40 sp. *Curc. sisymbrii* Hbst.
Subrhomboidal, squamous; rostrum elongated; pectoral groove short; tibiæ unarmed. Steph. Ill. M. pl. 20. f. 2.

CEUTORHYNCHUS *Sch.* Rhynchænus p. *Gyll.* *Curc. asperifoliarum* Gyll.
Subrhomboidal, scabrous; rostrum elongate; tibiæ unarmed; pectoral channel not extending beyond anterior coxæ.

CÆLIODES *Sch.* Ceutorhynchus p. *Curt.* *Curc. geranii* Payk. Curt. 670.
Antennæ 12-jointed; rostrum long; pectoral channel extending to intermediate coxæ; tibiæ with a tooth outside.

POOPHAGUS *Sch.* Miarus p. *Steph.* *Curc. nasturtii* Spence.
Antennæ 12-jointed; body somewhat elongated and depressed; femora with a tooth beneath. Steph. Ill. 20. f. 1.

MONONYCHUS *Sch.* Rynchænus p. *Fab.* 1 sp. *Rh. pseudacori* Fab.
Tarsi with a single terminal claw. Curt. 292.

RHINONCUS *Sch. olim.* Ceutorhynchus p. *Sch.* 13 sp. *Curc. pericarpius.* L.
Subrhomboidal; rostrum short, thick; tibiæ unarmed. Hbst. 6. 91. 12.

OROBITES *Sch.* Orobitis *Germ.* 1 sp. *Curc. cyaneus* Linn. Pz. 57. 10.
Elytra nearly globose, polished; pectoral groove short; tibiæ unarmed.

Division 4. *Cionides* Sch.

CIONUS *Clv.* Curculio p. *Linn.* 5 sp. *Curc. scrophulariæ* Linn.
Subglobose, squamose; antennæ 10-jointed; third joint long, clavate. Donov. 2. pl. 60.

CLEOPUS *Meg.* Cionus p. *Sch.* 1 sp. *Curc. pulchellus* Hbst.
Subelongate, ovate; antennæ 10-jointed; third joint moderate; rostrum bent. Hbst. 6. pl. 88. f. 1.

GYMNAETRON *Sch.* Cionus p. *Germ.* 1 sp. *Curc. beccabungæ.*
Ovate, convex, squamose; pygidium naked; antennæ 10-jointed. Curt. 627.

RHINUSA *Kirby.* GYMNAETRON p. *Sch.* 3 sp. *Curc. antirrhini* Pz.
Elytra depressed, subquadrate; anterior tibiæ minutely hooked; tip of rostrum slender. Panz. 26. 18.

MIARUS *Sch. olim.* GYMNAETRON p. *Sch.* 4 sp. *Curc. campanulæ* Linn.
Elytra abbreviated, subquadrate, subdepressed; antennæ 10-jointed; rostrum filiform. Hbst. 6. 70. f. 15.

MECINUS *Germ.* CURCULIO p. *Marsh.* 3 sp. *Curc. semicylindricus* M.
Elongate, subcylindric; pygidium covered; rostrum rather short, robust. Hbst. 6. 78. 6.

SPHÆRULA *Meg.* NANODES *Sch.* 1 sp. *Curc. Lythri* Pk. Pz. 17. 8.
Convex, attenuated behind; antennæ 9-jointed; elytra gibbous.

Division 5. *Rhyncophorides* Sch.

CALANDRA *Clv.* RHYNCOPHORUS *Hbst.* 2 sp. *Curc. granarius* Linn.
Antennæ 9-jointed; funiculus 6-jointed. Clv. 1. pl. 2.

Division 7. *Cossonides* Sch.

COSSONUS *Clairv.* CURCULIO p. *Pz.* 2 sp. *Curc. linearis* Fabr. Curt. 59.
Depressed; antennæ 9-jointed; funiculus 7-jointed; rostrum elongate, dilated at the tip.

RHYNCOLUS *Sch.* COSSONUS p. *Gyll.* 4 sp. *Curc. ater* Linn. Pz. 19. 14.
Antennæ 9-jointed; rostrum very short, broad, and depressed.

BARIS *Steph.* STENOSOMA *Kirby MSS.* 5 sp. *Curc. atriplicis* Pk.
Antennæ 9-jointed; rostrum linear, cylindric, longer than the head. Hbst. 6. pl. 71. 3.

Family 4. *SCOLYTIDÆ* Westw. (Scolytidæ p. *Steph.*)

HYLASTES *Erichson.* HYLURGUS p. *Steph.* 10 sp. *Hyles. ater* Fabr.
Funiculus 7-jointed; club 4-jointed, orbicular, compressed; tibiæ externally denticulate. Hbst. 5. pl. 48. 4.

DENDROCTONUS *Erichs.* HYLURGUS p. *Curt.* 1 sp. *Dermest. piniperda* L.
Funiculus 5-jointed; club 4-jointed, suborbicular, compressed; tibiæ denticulate. Curt. 104.

SCOLYTUS *Geoff.* ECCOPTOGASTER *Hbst.* 3 sp. *Scol. destructor* Oliv.
Funiculus 6-jointed; club solid, compressed, subovate; tibiæ compressed, entire, hooked. Curt. 43.

HYLESINUS *Fabr.* IPS p. *Marsh.* 8 sp. *Hyles. crenatus* Fabr. Curt. 522.
Funiculus 7-jointed; club 4-jointed, oblong, acuminate; tibiæ compressed at the tip, externally denticulate.

TRYPODENDRON *Steph.* { XYLOTERUS *Erichs.* / APATE *Kirby.* } 2 sp. *Derm. domesticus* L.
Funiculus 4-jointed; club solid; labium parallel; tibiæ serrated. Panz. 43. 19.

POLYGRAPHUS *Erichs.* HYLESINUS p. *Fabr.* 1 sp. *Hyl. pubescens* Fab.
Funiculus 4-jointed; club solid, suboval, acuminate; tibiæ denticulate. Panz. 15. 5.

TOMICUS *Latr.* BOSTRICHUS *Erichs.* 9 sp. *Derm. typographus* Linn.
Funiculus 5-jointed; club 4-jointed, tunicate; labium triangular. Panz. 15. 2.

PLATYPUS *Herbst.* CYLINDRA *Dufts.* 2 sp. *Pl. cylindrus* Herbst.
Funiculus 4-jointed; club nearly round; tarsi very long and slender; tibiæ striated. Curt. 51.

Stirps 2. *Eucerata* Westw. (Longicornes *Latr.*, Cerambycidæ *K. Linn. Trans.* vol. xii.)

Family 1. *PRIONIDÆ* Leach. (Cerambyx p. *Linn.*)

PRIONUS *Geoff.* CERAMBYX p. *Linn.* 1 sp. *Cer. coriarius* Linn. Don. 491.
Thorax dentate.

SPONDYLIS *Fabr.* ATTELABUS p. *Linn.* 1 sp. *Att. buprestoides* Linn.
Thorax entire, subglobose; tibiæ subserrate. Panz. 44. 19.

ASEMUM *Esch.* CALLIDIUM p. *Curt.* 1 sp. *Cer. striatum* Linn. Curt. 295.
Thorax entire, subdepressed; tibiæ simple.

Family 2. *CERAMBYCIDÆ* Leach. (Cerambyx and Necydalis *Linn.*)

Subfamily 1. *Cerambycides.*

NECYDALIS *Linn.* MOLORCHUS *Fabr.* 2 sp. *Nec. minor* Linn. Curt. 11.
Elytra very short, square.

(STENOPTERUS *Illig.* NECYDALIS p. *Linn.* 1 sp. *Nec. rufa* Linn.
Elytra not covering the wings, attenuated. Oliv. 4. pl. 1. 6.)

AROMIA *Serv.* CALLICHROMA p. *Latr.* 1 sp. *Cer. moschatus* Linn. Don. 94.
Depressed, elytra covering the wings, of equal breadth throughout; femora not clavate; antennæ glabrous; thorax tubercled.

CERAMBYX *Serv.* HAMATICHERUS *Meg.* 1 sp. *Cer. Heros* Fabr.
Subconvex; antennæ not spined; middle tibiæ simple; thorax transversely rugose. Panz. 82. 1.

CALLIDIUM *Fab.* CERAMBYX p. *Linn.* 12 sp. *Cer. bajulus* Linn. Curt. 295.
Broad, depressed; last joint of palpi obtrigonate; thorax depressed; sides unarmed; antennæ short.

(CYLINDERA *Newman.* ———— 1 sp. *Cyl. pallida* Newm.
Thorax elongate, subcylindric; elytra parallel; head as broad as the thorax.)

ARHOPALUS *Serv.* CALLIDIUM p. *Steph.* 1 sp. *Cer. rusticus* Linn. Pz. 70. 8.
Thorax subdepressed; femora short, clubbed, compressed; last joint of palpi triangular.

GRACILIA *Serv.* OBRIUM p. *Curt.* 1 sp. *Saperda minuta* Fab. Don. 553.
Narrow; thorax unarmed, depressed; maxillary palpi longer than the labial; antennæ 11-jointed; head inclined downwards.

CLYTUS *Fab.* LEPTURA p. *Linn.* 5 sp. *Lept. arietis* Linn. Curt. 199.
Thorax globose, unarmed; antennæ setaceous; elytra entire at the tip.

OBRIUM *Meg.* SAPERDA p. *Fab.* 1 sp. *Ce. Cantharinus* Linn. Curt. 91.
Slender; thorax obtusely tubercled at the sides; antennæ pubescent; tibiæ scarcely compressed.

(TRITOMACRUS *Newm.* ———— 1 sp. *Tritom. testaceus* Newm.
Slender; thorax long, depressed, broader than the head; antennæ longer than the body.)

Subfamily 2. *Lamiides.*

ÆDILIS *Serv.* ACANTHOCINUS *Meg.* 1 sp. *Æd. montana* Serv. Donov. 72.
Broad, flattened; thorax transversely tubercled; antennæ very long in ♂.

AGAPHANTIA *Serv.* SAPERDA *Leach.* 1 sp. *Sap. Cardui* Fabr. Don. 209.
Narrow, subcylindric; antennæ distinctly 12-jointed.

MESOSA *Serv.* APHELOCNEMIA *Steph.* 1 sp. *Cer. nabilus* Oliv. Curt. 172.
Broad, subdepressed; thorax transverse, unarmed; antennæ slender, pilose within; intermediate tibiæ simple.

TETROPS *K.* SAPERDA p. *Fab.* 1 sp. *Lept. præusta* Linn. Martyn 28. 12.
Narrow, subcylindric; eyes four; antennæ 11-jointed.

SAPERDA *Fab.* LAMIA p. *Leach.* 8 sp. *Cer. carcharias* Linn. Curt. 275.
Linear; thorax cylindric, unarmed; antennæ 11-jointed; tibiæ simple.

POGONOCHERUS *Serv.* LAMIA p. *Leach.* 3 sp. *Cer. hispidus* Linn.
Short, subconvex; antennæ pilose beneath; disc of thorax tubercled; elytra spined at the tip. Donov. 64.

LEIOPUS *Serv.* POGONOCERUS p. *Steph.* 1 sp. *Cer. nebulosus* Linn.
Short, subconvex; antennæ glabrous; femora clavate; elytra entire. Donov. 394.

MONOCHAMUS *Meg.* LAMIA p. *Fab.* 2 sp. *Cer. sutor* Linn. Curt. 519.
Elytra somewhat parallel; antennæ glabrous; anterior male tarsi hairy; fore legs long; thorax laterally spined.

LAMIA *Serv.* CERAMBYX p. *Linn.* 1 sp. *Cer. textor* Linn. Panz. 19. 1.
Thorax cylindric, subquadrate, spined at the sides; antennæ naked; legs robust, equal in both sexes.

Family 3. *LEPTURIDÆ* Leach. (Leptura *Linn.*)

RHAGIUM *Fab.* HARGIUM *Leach.* 3 sp. *Lept. inquisitor* Linn. Pz. 82. 4.
Broad, depressed; thorax spined on each side; antennæ short.

TOXOTUS *Meg.* LEPTURA p. *Linn.* 2 sp. *Cer. meridianus* Linn. Don. 435.
Elongate; thorax tubercled at the sides; antennæ long.

STRANGALIA *Serv.* LEPTURA p. *Auct.* 2 sp. *Lept. elongata* De G. Don. 84.
Thorax unarmed, narrowed in front, nearly flat above; body very narrow, nearly pointed behind; eyes globular; front of head produced.

LEPTURA *Linn. Serv.* ——— 11 sp. *Lept. 4-fasciata* Linn. Curt. 362.
Thorax unarmed, subconvex; eyes moderate; elytra attenuated.

GRAMMOPTERA *Serv.* LEPTURA B. *Steph. Cat.* 7 sp. *Lept. præusta* Fab.
Thorax unarmed, subconvex; elytra not attenuated; body linear. Panz. 34. 17.

PACHYTA *Meg.* LEPTURA p. *Curt.* 4 sp. *Lept. 8-maculata* Fab. Don. 353.
Robust; thorax subconical, with a slight obtuse tubercle on each side; elytra short, nearly parallel; humeral angles not prominent.

Stirps 3. *Phytophaga* Kirby.

Race 1. *Parameca* Westw. comprising the single

Family *CRIOCERIDÆ* Leach.

DONACIA *Fab.* LEPTURA p. *Linn.* 21 sp. *Don. crassipes* Fab. Curt. 494.
Antennæ with the fourth and following joints elongated; elytra entire at the tips.

MACROPLEA *Hoff.* HÆMONIA *Latr.* 2 sp. *Don. Zosteræ* Fab.
Antennæ with the fourth and following joints elongated; elytra mucronated. Curt. 318.

ORSODACNA *Latr.* CRIOCERIS p. *Fab.* 3 sp. *Ors. chlorotica* Latr.
Palpi thickened at the tips; thorax not tubercled; joints of antennæ short. Guer. Ic. R. A. 47.

CRIOCERIS *Geoff.* Lema p. *Fab.* 7 sp. *Chr. merdigera* Linn. Curt. 323.
Palpi filiform; joints of antennæ short; elytra broad.

ZEUGOPHORA *Kunz.* Lema p. *Gyll.* 2 sp. *L. subspinosa* Pz. Pz. 83. 10.
Palpi thickened; joints of antennæ short; thorax tubercled.

Race 2. *Cyclica* Latr.

Family 1. *CASSIDIDÆ.* (Cassida and Hispa *Linn.* Cassidiadæ *Leach.*)

CASSIDA *Linn. &c.* ——— 19 sp. *Cass. murræa* Linn. Curt. 127.
Suborbicular, flat beneath; mouth concealed by the prosternum; thorax covering the head.

HISPA *Linn.* Crioceris p. *Geoff.* 1 sp. *H. atra* Linn. Steph. Ill. pl. 23 f. 5.
Elongate-ovate, spinose; mouth exposed; head exserted.

Family 2. *GALERUCIDÆ* Steph.

Subfamily 1. *Galerucides* (Ambulatorii.)

AUCHENIA *Steph.* Crioceris p. *Panz.* 1 sp. *Chrys. 4-maculata* Linn.
Antennæ shorter than the body, with elongate joints, the second much shorter than the third. Curt. 366.

ADIMONIA *Schrank.* Chrysomela p. *Linn.* 2 sp. *Ch. halensis* Linn.
Antennæ with the second and third joints equal, short; labrum emarginate. Panz. 91. 9.

GALERUCA *Geoff.* Crioceris p. *Marsh.* 13 sp. *Chrys. Tanaceti* Linn.
Antennæ shorter than the body, with short joints, the second much shorter than the third. Curt. 371.

CALOMICRUS *Dillw.* Luperus p. *Curt.* 1 sp. *Cr. circumfusa* Marsh.
Antennæ long with the second and third joints equal, short; labrum entire. Panz. 21. 18.

LUPERUS *Geoff.* Crioceris p. *Fab.* 2 sp. *Chrys. flavipes* Linn.
Antennæ very long; the second and third joints short, equal. Curt. 370, details.

Subfamily 2. *Halticides.* (Saltatorii.)

HALTICA *Illig.* Chrysomela p. *Linn.* 44 sp. *Chrys. nemorum* Linn.
Oblong-ovate; thorax narrower than the elytra; posterior tarsi short, apical. Curt. 630.

THYAMIS *Steph.* Longitarsus *Latr.* 38 sp. *Halt. 4-pustulata* Ill. Pz. 88. 2.
Posterior tarsi elongate, apical; posterior tibiæ not dentate.

MANTURA *Steph.* Haltica p. *Illig.* 6 sp. *Chrys. rustica* Linn.
Oblong-ovate; thorax as broad as the elytra; posterior tarsi short, apical.

CARDIAPUS *Curtis.* ——— 1 sp. *C. Matthewsii* Curt. Curt. 435.
Subcylindrical; thorax as broad as the elytra; posterior tarsi short, apical.

MACROCNEMA *Steph.* Psylliodes *Latr.* 18 sp. *Chrys. hyoscyami* Linn.
Posterior tarsi elongate, inserted before the apex of the tibiæ which are not toothed. Curt. 486.

SPHÆRODERMA *Steph.* Haltica p. *Illig.* 6 sp. *Halt. globosa* Pz.
Hemispherical; antennæ with simple joints; posterior tarsi short, apical. Panz. 25. 13.

CHÆTOCNEMA *Steph.* Haltica p. *Auct.* 6 sp. *H. concinna* Marsh.
Posterior tibiæ externally dentate; head porrected. Ent. Hef. 3. f. 1.

DIBOLIA *Latr.* HALTICA p. *Auct.* 2 sp. *H. Cynoglossi* Ent. H.
Posterior tibiæ externally spined, with a long bifid spur; head retracted. Ent. H. 1. f. 2.

MNIOPHILA *Steph.* HALTICA p. *Auct.* 1 sp. *H. muscorum* Ent. H.
Hemispherical; eighth joint of antennæ very small; posterior tarsi short, apical. Ent. H. 2. f. 12.

Family 3. *CHRYSOMELIDÆ* Leach. (Chrysomela p. *Linn.*)

EUMOLPUS *Fabr.* CHRYSOMELA p. *Linn.* 4 sp. *Chrys. obscura* Linn.
Head vertical; antennæ as long as the body, thickened at the tips. Steph. pl. 23. f. 3.

CRYPTOCEPHALUS *Geoff.* CHRYSOMELA p. *Linn.* 22 sp. *Ch. sericea* Linn.
Head vertical; antennæ as long as the body, filiform. Curt. 35.

CLYTHRA *Laicharting.* CHRYSOMELA p. *Linn.* 5? sp. *Chr. 4-punctata* Linn.
Head vertical; antennæ short, serrated. Curt. 582.

HELODES *Payk.* PRASOCURIS *Latr.* 2 sp. *Chr. Phellandrii* Linn. Curt. 506.
Oblong; thorax quadrate; head exserted; wings two.

MELASOMA *Dillw.* LENA *Meg.* 5 sp. *Chrys. populi* Linn. Albin. pl. 63.
Head exserted; palpi filiform, truncate; thorax transverse; wings two.

TIMARCHA *Meg.* TENEBRIO p. *Linn.* 2 sp. *Ten. lævigatus* Linn. Don. 276.
Apterous; head exserted; elytra soldered together.

CHRYSOMELA *Linn. &c.* ——— 27 sp. *Chr. pallida* Linn. Curt. 111.
Winged; palpi subsecuriform; thorax transverse; head exserted.

PHÆDON *Meg.* CHRYSOMELA p. *Linn.* 14 sp. *Chrys. armoraciæ* Linn.
Winged; head exserted; thorax transverse; palpi filiform, obtuse, or acute, not truncate. Pz. 44. 15.

Sect. III. PSEUDOTRIMERA *Westw.* (Trimera *Latr.*)

Family 1. *EROTYLIDÆ* (Clavipalpi *Latr.*)

TRITOMA *Fab.* DERMESTES p. *Marsh.* 1 sp. *Tr. bipustulatum* Fab.
Body nearly hemispherical. Curt. 498.

TRIPLAX *Payk.* SILPHA p. *Linn.* 6 sp. *Silph. russica* Linn. Curt. 706.
Body oblong. Steph M. pl. 17. fig. 4—6.

Family 2. *ENDOMYCHIDÆ* Leach. (Fungicolæ *Latr.*)

ENDOMYCHUS *Payk.* CHRYSOMELA p. *Linn.* 1 sp. *Chrys. coccinea* Linn.
Thorax broadest behind; club of antennæ distinct, 3-jointed. Curt. 570.

LYCOPERDINA *Latr.* ENDOMYCHUS p. *Fabr.* 1 sp. *End. Bovistæ* Pk.
Thorax subcordate, truncate; club of antennæ indistinct. Curt. 355.

Family 3. *COCCINELLIDÆ* Leach. (Coccinella *Linn.* Aphidiphagi *Latr.*)

CHILOCORUS *Leach.* COCCINELLA *Auct.* 4 sp. *Cocc. bipustulata* Linn.
Elytra with a dilated margin; thorax lunate, hinder margins rounded. Martyn, 13. f. 21.

COCCINELLA *Linn.* ——— 34 sp. *Cocc. 7-punctata* Linn. Curt. 208.
Body glabrous, hemispherical; posterior angles of thorax acute.

SPHÆROSOMA *Leach.* ——— *Sph. quercus* Leach.
Spherical, pilose; antennæ with an abrupt club.

SCYMNUS *Herbst.* NITIDULA p. *Fabr.* 16 sp. *Scym. nigrinus* Hbst.
Hemispherical, pubescent; antennæ short, abruptly clavate. Panz. 24. 12.

RHYZOBIUS *Steph.* NITIDULA p. *Fabr.* 1 sp. *Nit. Litura* Fab. Pz. 35. 5.
Elytra convex, pubescent; antennæ moderate, subclavate.

CACICULA *Meg.* CACIDULA *Dej.* 2 sp. *Chrys. scutellata* Fab. Curt. 144.
Elytra oval, subconvex, punctate-striate; antennæ moderate.

ORDER II. EUPLEXOPTERA *Westw.* (DERMAPTERA *Leach*, nec *Retzius, De Geer*), containing the single

Family *FORFICULIDÆ* Stephens.

FORFICULA *Linn.* FORFICULA a. *Géné.* 4 sp. *F. auricularia* Curt. 560.
Antennæ 14-jointed; tegmina and wings perfect.

APTERYGIDA * *Westw.* CHELIDURA *Steph.* nec *Latr.* 1 sp. *F. pedestris* Bon.
Antennæ 12-jointed; tegmina perfect; wings wanting.

LABIA *Leach.* FORFICULA p. *Latr.* 1 sp. *F. minor* Linn. Sam. pl. 4. 16.
Antennæ 10—12-jointed; tegmina and wings perfect.

FORFICESILA † *Latr.* LABIDURA *Leach.* 1 sp. *F. gigantea* Fab.
Antennæ with about 25 joints; tegmina and wings perfect. K. & S. pl. 1. f. 7.

ORDER III. ORTHOPTERA *Olivier.* (HEMIPTERA *Retzius*, nec *De Geer*, HEMIPTERA p. *Linn.*)

Sect. I. CURSORIA, containing the single

Family 1. *BLATTIDÆ* Stephens. (Order Dictyoptera *Leach.*)

ECTOBIA *Westw.* BLATTA *Serv.* 8 sp. *Bl. lapponica* Fabr. Curt. 556.
Tarsi with the three basal joints gradually diminishing in length; the basal joint no so long as the four others united; fourth sub-bilobed; anal styles not prominent.

(BLATTA *Linn.* { KAKERLAC *Latr.* / STELEOPYGA *Fisch.* } 3 sp. *Bl. orientalis* Linn. Pz. 90. 12.)

Sect. II. RAPTORIA (Fam. 2. *Mantidæ*).

Sect. III. AMBULATORIA (Fam. 3. *Phasmidæ*).
(There are no British species of these two sections.)

Sect. IV. SALTATORIA.

Family 4. *ACHETIDÆ* Leach. (Gryllides *Latreille.*)

GRYLLOTALPA *Ray.* GRYLLUS (ACHETA) p. *Linn.* 1 sp. *G. vulgaris* Latr.
Forelegs palmate; ovipositor not exserted. Curt. 456.

ACHETA *Fabr.* GRYLLUS (ACHETA) *Linn.* 3 sp. *A. domestica.* Curt. 293.
Forelegs simple; ovipositor long, exserted.

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* If the genera Chelidura and Labia be retained, it will be equally correct to form the species discovered by me at Ashford, Kent, and described by Stephens, under the name of Chelidura albipennis, into a separate genus.

† I have employed Latreille's name, that of Labidoures having been given to the entire group by Dumeril and L. Dufour.

Family 5. *GRYLLIDÆ* Leach. (Locustariæ *Latr.*)

EPHIPPIGER *Latr.* Barbitistes *Charp.* 1 sp. *E. virescens* Steph.
Tegmina very short, ocellated in ♂; very minute, rugose in ♀; wings 0; vertex subacuminate; ovipositor broad, short, incurved.

MICROPTERYX *Steph.* Anisoptera *Serv.* 3 sp. *G. brachyptera* Linn.
Tegmina nearly as long as abdomen, ocellated in ♂; front broad, obtuse, rounded; wings none, or rudimental. De Geer, 3. pl. 22. f. 2, 3.

XIPHIDION *Latr.* Locusta p. *Fab.* 2 sp. *L. fusca* Fab. Panz. 33. f. 2.
Tegmina more or less elongated, ocellated in ♂; wings unfit for flight; head acuminate in front; eyes exserted.

MECONEMA *Serv.* Locusta p. *Latr.* 1 sp. *L. varia* Fab. Donov. 3. pl. 79.
Slender; tegmina long, not ocellated in ♂; wings ample; front acuminate; abdomen ♂ terminated by two long incurved processes.

PHASGONURA *Westw.* Locusta *Serv.* 1 sp. *G. viridissimus* Linn.
Tegmina and wings long, ocellated in ♂; front acuminate; apex of abdomen with four short styles; ovipositor long, straight. Donov. 4. pl. 130.

DECTICUS *Serv.* Acrida p. *Curt.* 3 sp. *Gr. verrucivorus* Linn. Curt. 82.
Tegmina and wings long, ocellated in ♂; front obtuse; eyes sessile; ovipositor long, more or less incurved.

Family 6. *LOCUSTIDÆ* Leach. (Acridii *Latr.*)

LOCUSTA *Leach.* Œdipoda *Latr.** 22 sp. *G. flavipes* Gmel. Curt. 608.
Prothorax not scutelliform; antennæ simple; wings and tegmina ample.

PODISMA *Latr.* Gryllus p. *Linn.* 1 sp. *G. pedestris* Linn. Panz. 30. 8.
Tegmina and wings very short, unfit for flight; antennæ simple.

GOMPHOCERUS *Leach.* Gomphoceros *Thunb.* 8 sp. *G. rufus* Linn.
Antennæ clavate. Steph. 6. pl. 28. f. 6.

TETRIX *Latr.* Acrydium *Fab.* 3 sp. *G. subulatus* Linn. Curt. 439.
Prothorax produced behind over the abdomen; tegmina very minute; wings ample.

Order IV. THYSANOPTERA *Haliday.*

Note. — The following is an abstract of the arrangement of these insects given by Mr. Haliday in the 15th Number of the *Entomological Magazine.*

Stirps and Family 1. Tubulifera. Antennæ 8-jointed; no borer in the female.

Gen. 1. *Phlœothrips.*

Sect. a. Ocelli and wings 0. 1 sp. *P. pedicularia.*

Sect. aa. Ocelli 3; wings complete or abbreviated.

Subs. b. Sides of head parallel. 5 sp. *P. aculeata* Fab.

Subs. bb. Sides of head converging in front. 2 sp. *P. coriacea.*

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* Latreille gives the name of Œdipoda to those locusts which are destitute of a prosternal point, calling the larger species which have a strong point Acrydium. As the migratory locust belongs to the former group, it is proper that it should retain the name of Locusta, whilst the rejection of the name of Acrydium, for the reasons given in the body of my work, has rendered the adoption of another name necessary for the larger species, and which I have elsewhere named Rutidoderes.

Stirps 2. TEREBRANTIA. Antennæ typically 9-jointed; females with a 4-valved borer.

Fam. 2. STENELYTRA. Borer curved downwards; elytra narrow, with longitudinal nerves alone.

Gen. 2. *Heliothrips.* Body reticulated; wings nearly capillary. 1 sp. *H. adonidum.*

Gen. 3. *Sericothrips.* Body smooth; abdomen tomentose; wings abbreviated. 1 sp. *S. Staphylinus.*

Gen. 4. *Thrips.* Body smooth, glabrous.

Subg. 1. *Chirothrips.* Ocelli 3; prothorax produced in front, narrowed. 1 sp. *Th. manicata.*

Subg. 2. *Limothrips.* Ocelli 3; prothorax of equal breadth; last segment armed with two dorsal spines in ♀. 2 sp. *Th. Cerealium.*

Subg. 3 *Aptinothrips.* Ocelli and wings 0; prothorax of equal breadth. 2 sp. *Th. rufa* Gmel.

Subg. 4. *Thrips* proper. Last segment unarmed; style shorter than sixth joint of antennæ. 23 sp. *T. physapus.*

Subg. 5. *Belothrips.* Last segment unarmed; style of antennæ longer than sixth joint. 1 sp. *Th. acuminata.*

Fam. 3. COLEOPTRATA. Borer recurved; elytra broad, with longitudinal and transverse nerves.

Gen. 5. *Melanthrips.* Antennæ distinctly 9-jointed; fore-wings with three transverse nerves. 1 sp. *Mel. obesa.*

Gen. 6. *Æolothrips.* Antennæ apparently 5-jointed; the four terminal joints very minute and soldered into a compact mass.

Subg. 1. *Coleothrips.* Subdepressed; fore-wings with four transverse nerves. 2 sp. *Thrips fasciata* Linn.

Subg. 2. *Æolothrips* proper. Cylindrical; wings rudimental. 1 sp. *Æ. albicincta.*

ORDER V. NEUROPTERA *Linn.*

Sect. I. BIOMORPHOTICA *Westw.*

Family 1. *TERMITIDÆ* Leach.

(There is no British species of this family.)

Family 2. *PSOCIDÆ* Leach. (Psoquilii *Latreille.*)

PSOCUS *Latr.* HEMEROBIUS p. *Linn.* 43 sp. *H. bipunctatus* Linn. Pz. 94. 21. Head broad; posterior margin of fore-wings with four cells.

CÆCILIUS *Curt.* ———— 4 sp. *C. fenestratus* Curt. Curtis 648. Tarsi 2-jointed; posterior margin of fore-wings with three cells.

ATROPOS *Leach.* TERMES p. *Linn.* 1 sp. *T. pulsatorium* Linn. Wood, pl. 75. Apterous; tarsi 3-jointed; posterior femora thickened; abdomen oblong-ovate, depressed; head oblong.

LACHESILLA *Westw.* Atropos p. *Leach.* 1 sp. *T. fatidicum* Linn.
Head transverse; tarsi 2-jointed; wings 0 in ♀, 2 short in ♂; legs slender. My fig. 59. 16.

Family 3. *PERLIDÆ* Leach. (Perlariæ p. *Latr.*)

PERLA *Geoff.* Semblis p. *Fabr.* 4 sp. *Phryg. bicaudata* Linn. Curt. 190.
Abdomen robust; bisetigerous; wings ♂ abbreviated.
ISOGENUS *Newm.* ——— 1 sp. *I. nubecula* Newm. Steph. 6. pl. 31. f. 2.
Abdomen robust, bisetigerous; wings alike in both sexes.
CHLOROPERLA *Newm.* Perla p. *Latr.* 6 sp. *P. lutea* Latr.
Abdomen slender; wings alike in both sexes; nerves fewer than in Isogenus.
NEMOURA *Latr.* Semblis p. *Fabr.* 14 sp. *P. nebulosa* Linn.
Abdomen not setigerous; antennæ slender, setaceous. Steph. 6. pl. 31. f. 3.
LEUCTRA *Steph.* Nemoura p. *Steph.* 3 sp. *L. geniculata* St. St. 6. pl. 31. f. 4.
Abdomen not setigerous; antennæ more robust, submoniliform; wings elongated, acuminated.

Family 4. *EPHEMERIDÆ* Leach. (Ephemerinæ *Latr.*)

EPHEMERA *Linn.* Ephemera A. *Steph.* 6 sp. *E. vulgata* Linn. Curt. 708.
Wings four; three anal filaments; head of larva cornuted.
LEPTOPHLEBIA *Westw.* Ephemera B. *Steph.* 10 sp. *E. vespertina* De G.
Wings four; three anal filaments; head of larva unarmed. (2. pl. 17. f. 15.)
BAETIS *Leach.* Ephemera p. *Linn.* 23 sp. *Eph. bioculata* Linn.
Wings four; abdomen with two terminal filaments. St. 6. pl. 29. f. 2.
BRACHYCERCUS *Curt.* Ephemera p. *Fabr.* 5 sp. *Eph. brevicauda* Fab.
Wings two; abdomen with three filaments scarcely longer than the body. Harris, Exp. pl. 6. f. 3.
CŒNIS *Steph.* ——— 2 sp. *C. macrura.* St. 6. pl. 29. f. 1.
Wings two; abdomen with three filaments several times longer than the body.
CLOEON *Leach.* Ephemera p. *Linn.* 10 sp. *Eph. diptera* Linn.
Wings two; posterior pair obsolete; abdomen with two setæ. St. 6. pl. 29. f. 3.

Family 5. *LIBELLULIDÆ* Westw. (Libellulina *MacL.*)

Subfamily 1. *Libellulides* Westw. (Libellulidæ *Leach.*)

ANAX *Leach.* Libellula p. *V. L.* 1 sp. *An. formosa* V. L.
Ocelli in a row; eyes contiguous; wings acuminated; anal angle of posterior pair rounded.
ÆSHNA *Fabr.* Libellula p. *Linn.* 7 sp. *L. grandis* Linn. Donov. 337. f. 2.
Ocelli in a row; eyes contiguous; wings obtuse; anal angles of posterior pair more or less angulated in ♂.
CORDULEGASTER *Leach.* Libellula p. *Linn.* 1 sp. *Æ. annulata* Latr.
Ocelli in a row; abdomen clavate; anal angle of posterior wings strongly angulated. Donov. 4. 30.
GOMPHUS *Leach.* Libellula p. *Linn.* 2 sp. *L. vulgatissima* Linn. Donov. 423.
Ocelli in a line; eyes remote in both sexes; abdomen clavate.
CORDULIA *Leach.* Libellula p. *Linn.* 3 sp. *L. ænea* Linn. Curt. 616.
Ocelli in a triangle, metallic-coloured; anal angle of posterior wings angulated in ♂.

LIBELLULA *Linn.* ——— 15 sp. *L. depressa* Linn. Curtis 712.
Ocelli in a triangle, generally broad and depressed; anal angle of posterior wings rounded in both sexes.
[Platetrum *Newm.*, L. depressa. Leptetrum *Newm.*, L. 4-maculata. Orthetrum *Newm.*, L. cancellata. Sympetrum *Newm.*, L. scotica.]

Subfamily 2. *Agrionides* Westw. (Agrionidæ *Leach.*)

AGRION *Fab.* LIBELLULA p. *Linn.* 13 sp. *L. puella* Linn. Steph. 6. pl. 29. f. 4.
Wings membranous; stigma rhomboidal; areolets mostly quadrangular.
LESTES *Leach.* AGRION p. *Fab.* 3 sp. *L. viridis* V. L.
Wings membranous; stigma large, oblong-quadrate; areolets mostly pentagonal.
CALEPTERYX *Linn.* AGRION p. *Fab.* 4 sp. *L. virgo* Linn. Donov. 36. f. 1.
Wings coriaceo-membranous; stigma obsolete; areolets extremely numerous.

Sect. II. SUBNECROMORPHOTICA *Westw.*

Family 6. *MYRMELIONIDÆ* Leach.

(There is no British species of this family.)

Family 7. *HEMEROBIIDÆ* Westw. (Hemerobidæ *Leach.*)

OSMYLUS *Latr.* HEMEROBIUS p. *Fabr.* 1 sp. *O. maculatus* Fab. Sam. pl. 7. f. 4.
Ocelli three; placed in a triangle on the forehead.
DREPANEPTERYX *Leach.* HEMEROBIUS p. *Linn.* 1 sp. *H. phalænoides* Linn.
Ocelli 0; anterior wings very broad; posterior margin subfalcate.
CHRYSOPA *Leach.* HEMEROBIUS p. *Linn.* 13 sp. *H. perla* Linn. Curt. 520.
Ocelli 0; wings entire; antennæ cylindrical; labrum notched.
HEMEROBIUS *Linn.* p. ——— 32 sp. *H. hirtus* Linn. Curt. 202.
Ocelli 0; wings entire; antennæ submoniliform; labrum entire.
CONIOPTERYX *Curt.* { CONIORTES *Westw.* / MALACOMYZA *Wesm.* } 3 sp. *H. parvulus* Vill.
Tarsi 5-jointed; wings covered with white powder; with few nerves, the nerves disposed nearly alike in all the wings; labial palpi terminated by a large ovate joint. Curt. 528.

Family 8. *SIALIDÆ* Leach.

SIALIS *Leach.* SEMBLIS p. *Fab.* 1 sp. *Hem. lutarius* Linn. Pictet, Ann. Sc. Nat.
Ocelli 0; wings deflexed; tarsi 5-jointed, fourth joint bifid. (N. S. 5. pl. 3.)

Family 9. *PANORPIDÆ* Leach. (Panorpatæ *Latr.*)

PANORPA *Linn.* ——— 5 sp. *P. communis* Linn. Curt. 696.
Wings four, large; mandibles bidentate; abdomen ♂ long, recurved, armed with a forceps.
BOREUS *Latr.* PANORPA p. *Linn.* 1 sp. *P. hyemalis* Linn. Curt. 118.
Wings in ♂ rudimental, in ♀ obsolete; mandibles multidentate; abdomen ♂ short, unarmed.

Family 10. *RAPHIDIIDÆ* Leach. (Raphidini *Latr.*)

RAPHIDIA *Linn.* ——— 5 sp. *R. ophiopsis* Linn. Curt. 37.
Prothorax long; ovipositor ♀ long and exserted.

Family 11. *MANTISPIDÆ* Westw.

(There is no British species of this family.)

Order VI. TRICHOPTERA *Kirby.*

Family *PHRYGANEIDÆ* Westw.

Subfamily 1. *Phryganeides* Westw. (Phryganidæ *Stephens.*)

AGRYPNIA *Curtis.* ——— 1 sp. *A. Pagetana* Curt. Curt. 540.
Tibiæ spinulose; head and body very broad, depressed; nerves of wings as in Anabolia.

LIMNEPHILUS *Leach.* Phryganea p. *Oliv.* 50 sp. *P. grisea* Linn. Curt. 488.
Body not depressed; wings narrow, obliquely truncated at tip; max. palpi with the last point short; 5-jointed in both sexes.

GLYPHOTÆLIUS *Steph.* Limnephilus p. *Curt.* 1 sp. *Ph. pellucida* Oliv.
Anterior wings with the hinder margin cut out.

HALESUS *Steph.* Phryganea p. *Schr.* 7 sp. *P. digitata* Schr. Pictet, pl. 6. f. 1, 2.?
Anterior wings broad, dilated at the tip, and rounded; max. palpi with the last joint short, subelliptic.

ANABOLIA *Steph.* Limnephilus p. *Lea.* 2 sp. *A. nervosus* Lea.
Wings narrow, rounded at the tip; body subcompressed; last joint of max. palpi short, subelliptic. Samo. pl. 7. f. 3.

DRUSUS *Steph.* Phryganea p. *Gmel.* 5 sp. *Ph. testacea* Gm. St. 6. pl. 34. f. 3.
Anterior wings rather broad, short, somewhat dilated in the inner margin, not setose; palpi long, pilose.

CHÆTOPTERYX *St.* Phryganea p. *Pict.* 2 sp. *P. villosa* Fab. Pict. 7. f. 4
Body not depressed; wings very broad, granulated; with erect rigid setæ.

PHRYGANEA *Linn. &c.* ——— 5 sp. *P. grandis* Linn. Curt. 592.
Tibiæ spinulose; wings pilose; palpi ♂ 4-jointed, 5-jointed in ♀; last joint of max. palpi short, subelliptic.

NEURONIA *Lea.* Phryganea p. *Linn.*? 1 sp. *P. fusca* L.? Steph. 6. 34. f. 2.
Tibiæ not spinulose; wings transparent; antennæ short, stout.

Subfamily 2. *Hydropsychides* W. (Hydropsychidæ *Steph.*)

PHILOPOTAMUS *Leach.* ——— 3 sp. *P. scopulorum* Lea.
Anterior tibiæ 2-spurred; antennæ longer than the wings; posterior wings small, unfolded; anterior with a transverse oblique nerve about the middle of the costa. Donov. pl. 548. f. 1.

PLECTROCNEMIA *Steph.* Hydropsyche p. *Pict.* 3 sp. *P. conspersus* Curt.
Anterior tibiæ 3-spurred; wings shorter than the antennæ, with but few transverse nerves. Pictet, pl. 19. f. 1.

CYRNUS *Steph.* Hydropsyche p. *Pictet.* 4 sp. *C. urbanus.* Pictet, pl. 19. f. 13.
Anterior wings with various transverse nerves, with a transparent discoidal spot; anterior tibiæ 3-spurred; antennæ shorter than the wings.

POLYCENTROPUS *Curtis.* Amathus *Steph. G.* 9 sp. *P. irroratus* C.
Antennæ shorter than the wings, the latter with but few transverse nerves; anterior tibiæ 3-spurred; four posterior with four spurs. Curt. 544.

DIPLECTRONA *Westw.* Aphelocheira *Steph.* 2 sp. *P. flavo-maculata* Pict.
Anterior tibiæ 2-spurred; antennæ shorter than the wings, which are broad, without any transverse subcostal nerve. Steph. 6. pl. 32. f. 3.

HYDROPSYCHE *Pict.* Philopotamus p. *Steph. Cat.* 9 sp. *H. instabilis* C.
Anterior tibiæ 2-spurred; antennæ longer than the wings; posterior wings ample, folded, with a trifid central nervure. Curt. 601.

Subfamily 3. *Leptocerides* W. (Leptoceridæ *Leach, Steph.*)

LEPTOCERUS *Leach.* Mystacida *Latr.* 28 sp. *P. niger* Linn. Curt. 57.
Posterior tibiæ 2 spurred; basal joint of max. palpi short; terminal joint sometimes very long; antennæ exceedingly long.

CERACLEA *Lea.* Phryganea p. *Latr.* 1 sp. *P. nervosa.* Coq. tab. 3. f. 1.
Posterior tibiæ 2-spurred; two basal joints of max. palpi short; antennæ very long; wings transparent.

MOLANNA *Curt.* Amblypteryx *Steph. Cat.* 2 sp. *M. angustata* Curt.
Posterior tibiæ 4-spurred; antennæ robust, not denticulated in ♂; shorter than the wings, which are long and narrow. B. E. 716.

ODONTOCERUS *Leach.* Phryganea p. *Scopol.* 2 sp. *P. albicornis* Scop.
Posterior tibiæ 4-spurred; antennæ slender, denticulated in ♂; second pair of legs in larva longer than the posterior pair. Steph. 6. pl. 34. f. 1.

Subfamily 4. *Sericostomides* W. (Sericostomidæ *Steph.*)

POTAMARIA *Leach.* Phryganea p. *Fab.* 1 sp. *P. analis* F. Steph. 6. pl. 34. f. 4.
Anterior tibiæ destitute of spurs; antennæ stout, shorter than the wings.

SERICOSTOMA *Latr.* Prosoponia *Lea.* 1 sp. *S. Spencii* K. St. 6. 33. f. 2.
Anterior and intermediate tibiæ 2-spurred; maxillary palpi ♂ mask-like.

NOTIDOBIA *Steph.* Sericostoma p. *Pict.* 1 sp. *P. atrata* F.
Anterior tibiæ 2-spurred, intermediate 4-spurred; basal joint of antennæ short, incrassated, approximated; anterior wings with a subovate discoidal cell. Pictet, pl. 14. f. 5. a, c.

SILO *Curtis.* Phryganea p. *Fab.* 1 sp. *P. pallipes* Fab.
Maxillary palpi ♂ divaricating; basal joint of antennæ very long, naked; anterior tibiæ 2-spurred, intermediate 4-spurred.

GOERA *Hoff.* Phryganea p. *Fabr.* 5 sp. *P. pilosa* Fab.
Maxillary palpi ♂ short, recurved; basal joint of antennæ long, naked; anterior tibiæ 2-spurred, intermediate 4-spurred; wings silky.

MORMONIA *Curt.* Phryganea p. *Fab.* 5 sp. *N. nigro-maculata.*
Basal joint of antennæ elongate, very hirsute; anterior tibiæ 2-spurred, intermediate 4-spurred; palpi short. Steph. 6. pl. 32. f. 2.

BRACHYCENTRUS *Curt.* Mերoe *Steph. G.* 3 sp. *B. subnubilus* Curt.
Anterior tibiæ 2-spurred, intermediate 4-spurred; spurs very short; antennæ remote; palpi short.

Subfamily 5. *Psychomyiides?* W. (Psychomidæ? *Steph.*)

CHIMARRA *Leach.* Phryganea p. *Linn.* 1 sp. *P. marginata* L. Curt. 561.
Palpi very long; second and third joints long; wings destitute of transverse nerves; anterior tibiæ without spurs.

Subfamily 6. *Rhyacophilides* W. (Rhyacophilidæ *Steph.*)

BERÆA *Steph.* Thya *Curt.* 4 sp. *P. pygmæa* F. Pictet, pl. 16. 21.? 23.?
Anterior tibiæ 2-spurred; discoidal cell wanting; basal joint of antennæ large; palpi robust, hairy.

GLOSSOSOMA *Curt.* ——— 2 sp. *G. Boltoni* Curt. Steph. 6. 32. f. 1.
Anterior tibiæ 2-spurred; all the wings with a discoidal cell; anterior with a callous basal spot in ♂.

TINODES *Leach.* Phryganea p. *Fab.* 9 sp. *P. pusillus* F.
Anterior wings with two discoidal cells; posterior without a discoidal cell; anterior tibiæ 2-spurred.

ANTICYRA *Curt.* Rhyacophila p.? *Pict.* 4 sp. *A. phæopa* Ste. Pict. pl. 16. 9.?
Anterior tibiæ 2-spurred; discoidal cell wanting; wings long, narrow; basal joint of antennæ small.

AGAPETUS *Curt.* Rhyacophila p. *Pict.* 6 sp. *A. fuscipes* Curt.
Wings short, rounded; basal joint of antennæ small; discoidal cell wanting; ♂ with a ventral spine. Pictet, pl. 16, 17. 19. &c.

RHYACOPHILA *Pict.* Philopotamus p. *Curt.* 4 sp. *R. vulgata* Pict.
Anterior tibiæ 3-spurred; max. palpi rather long, slender; larvæ with external gills.

Subfamily 7. *Hydroptilides* W. (Hydroptilidæ *Steph.*)

NARYCIA *Ste.* ——— 1 sp. *N. elegans* Steph. Ill. 6. pl. 32. f. 4.
Antennæ pectinated; wings clothed with scale-like hairs.

AGRAYLEA *Curt.* ——— 2 sp. *A. 6-maculata* Curt.
Antennæ simple; intermed. tibiæ 1-spurred in the middle; wings long, narrow, pubescent.

HYDROPTILA *Dalm.* ——— 6 sp. *H. Tineoides* Dalm. An. Ent. t. 3.
Antennæ simple; intermed. tibiæ 2-spurred in the middle; fore wings narrow, very pilose.

Order VII. HYMENOPTERA *Linn.** (Piezata *Fab.*)

Sect. I. Terebrantia *Latr.* (*H. aberrantia* Westw. *H. ditrocha* Hartig.)

Subsect. 1. *Phytiphaga* Westw. (Sessiliventres *St. Farg. Hal.*)

Tribe 1. *Serrifera* St. Farg. Hal.; consisting of the single

Family *TENTHREDINIDÆ* Leach.

Subfamily 1. *Cimbicides* Westw.

CIMBEX *Oliv.* Crabro *Geoffr.* 8 sp. *T. femorata* Linn. Curt. 41.
Antennæ with five joints preceding the club, which consists of two joints soldered together; spurs obtuse; anterior tarsi ♂ spined beneath; labrum narrow.

TRICHIOSOMA *Leach.* Cimbex p. *Oliv.* 9 sp. *T. Lucorum* Linn. Curt. 49.
Antennæ with five joints preceding the club, which is 3-jointed; body hairy; labrum broad; base of abdomen not membranous.

CLAVELLARIA *Lam.* Cimbex p. *Oliv.* 2 sp. *T. Amerinæ* Linn. Curt. 93.
Antennæ with four joints preceding the exarticulate club; spurs obtuse; base of abdomen not membranous; joints of palpi short.

ZARÆA *Leach.* Cimbex p. *Oliv.* 1 sp. *T. fasciata* Linn. Curt. 97.
Antennæ with four joints preceding the 2-jointed club; joints of max. palpi long and irregular; spurs obtuse.

ABIA *Leach.* Cimbex p. *Oliv.* 2 sp. *T. sericea* Linn. Curt. 89.
Antennæ with four joints preceding the 3-jointed club; labrum broad; spurs obtuse; body metallic; ♂ with a dorsal silken patch.

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* I regret that I did not receive Mr. Haliday's talented '*Hymenopterorum Synopsis*,' until too late to make use of it in my text; I have however added his groups in this Synopsis, as synonyms, rather than entirely omit them. His primary divisions of the order are Sessiliventres and Petioliventres, which the identical structure of the ovipositor of Urocerus and Ichneumon appears to me to oppose.

AMASIS *Leach.* CIMBEX p. *Oliv.* 2 sp. *T. obscura* Fab. Pz. 84. 13.
Antennæ with four joints before the exarticulate club; spurs of four posterior tibiæ acute.

Subfamily 2. *Hylotomides* Westw.

HYLOTOMA *Fab.* ARGE *Schr.* 14 sp. *T. enodis* Linn. Curt. 65.
Antennæ elongate, subclavate, and nearly glabrous in ♀; simple and pilose in ♂; marginal cell appendiculated.

PTILIA *St. Farg.* HYLOTOMA A. *Steph.* 1 sp. *H. pilicornis* Leach.
Antennæ short, nearly filiform and pilose ♀; third submarginal cell produced at the tip.

SCHIZOCERUS *Latr.* HYLOTOMA p. *Klug.* 2 sp. *H. furcata* Vill. Curt. 58.
Antennæ ♂ furcate; ♀ long and simple; marginal cell not appendiculated.

Subfamily 3. *Tenthredinides* Westw.

ATHALIA *Leach.* ALLANTUS p. *Klug.* 10 sp. *T. Rosæ* Linn. Curt. 617.
Antennæ 9 or 10-jointed; third joint long; terminal joints subclavate; two marginal and four submarginal cells.

SCIAPTERYX *Steph.* TENTHREDO p. *Fab.* 1 sp. *T. costalis* Fab.
Antennæ 9-jointed, short, stout; joints irregular; wings thick and broad; marginal cells divided by a curved vein.

SELANDRIA *Leach.** HYLOTOMA p. *Fabr.* 40 sp. *Hyl. serva* Fabr.
Antennæ short, 9-jointed; terminal joints simple; body short and broad; two marginal and four submarginal cells; wings thin. Pz. 69. 17.

HEMICHROA *Steph.* DINEURA (*Leptocerca* Hartig). 3 sp. *T. Alni* Linn.
Antennæ 9-jointed; long, slender; two marginal, four submarginal cells, the second receiving two recurrent nerves; body as in Selandria. Steph. pl. 38. f. 2.

DINEURA *Dahlb.* TENTHREDO p. *Steph.* 1 sp. *T. De Geeri* Kl.
Two marginal, four submarginal cells, the second receiving two recurrent nerves; antennæ 9-jointed; body as in Nematus. De G. 2. pl. 38. f. 8—10.

(? MESONEURA *Hartig.* SELANDRIA p. *Steph.* 1 sp? *T. verna* Klug? ——)

ALLANTUS *Panzer.* TENTHREDO p. *Klug.* 47 sp. (St.) *T. Scrophulariæ* Linn.
Two marginal, four submarginal cells; antennæ subclavate or setaceous; third joint longer than the fourth; abdomen elongate; hind legs long; clypeus deeply notched. Sam. pl. 8. f. 2.

Obs. Hartig restricts this group (as a subgenus) to T. scrophulariæ, and its immediate allies (Stephens's first eight species).

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* *Obs.* Hartig has divided Selandria (which he considers only a subgenus of Tenthredo *Kl.*) into four sections, named from peculiarities of the larvæ, as noticed in my Vol. II. p. 100, 101.: — 1. Blennocampa (subdivided into three named tribes: 1. Blennocampa; 2. Monophadnus; and 3. Phymatocera *Dhlbom.*); 2. Hoplocampa; 3. Eriocampa; and 4. Selandria proper. The following are British types of these groups: Phymatocera not being indigenous.

1. Blennocampa. 1. Blennocampa proper. Selandria Ephippium. Pz. 52. 5. T. fuliginosa *Sch.* T. Betuleti *Kl.* T. Æthiops *Fab.*
——— 2. Monophadnus. T. Spinolæ *Kl.* T. luteiventris *Kl.* T. albipes *Gmel.* Tenthr. melanocephalus *Fab., Steph.*
2. Hoplocampa. T. chrysorrhæa *Kl. Newm.* T. ferruginea *Fab.* Pz. 90. 9. T. testudinea *Kl. &c.*
3. Eriocapam. T. adumbrata *Kl.* T. cinxia *Kl.* T. varipes *Kl. &c.*
4. Selandria proper. H. serva *Fab.* T. Morio *Fab.* Pz. 69. 17.

TENTHREDO* *Leach.* ——— 28 sp. (*Steph.*) *T. nassata* Linn.
Two marginal, four submarginal cells; antennæ rather long and slender; third and fourth joints equal; abdomen rather long, depressed; legs moderate; clypeus scarcely notched. Pz. 65. 2. ♂.

MACROPHYA *Dhlb.* ALLANTUS p. *Steph.* 9 sp. *T. rusticus* Linn. Pz. 64. 10.
Antennæ 9-jointed; body moderately long; posterior coxæ very large; each of second and third submarginal cells receiving a recurrent nerve (T. blanda *Fab.* Pz. 65. 9. T. punctum *F.* Pz. 26. 21.; and the species above mentioned are the types of Dahlbom's three sections of the genus.)

PACHYPROTASIS *Hartig.* TENTHREDO A. *Steph.* 4 sp. *T. Rapæ* Linn.
Antennæ longer than the abdomen, slenderer than in Tenthredo; posterior coxæ very large. (Hartig makes this a section of Macrophya.) Schäff. Ic. 179. 1.

ASTICTA *Newm.* Ent. Mag. vol. iv. 261.; v. 484. 1 sp. *A. Ianthe.*
Antennæ short, slender, 9-jointed; second joint twice the length of the first; third twice the length of the second; fourth scarcely shorter than the third; the remainder gradually shorter; stigma distinct, membranous; two marginal and three or four submarginal cells; the second and third receiving a recurrent nerve.
Obs. This description is drawn from Mr. Newman's typical specimen, which he has been so kind as to lend me; and of which the fore wings are unlike, the transverse nerve separating the first two submarginal cells being obliterated in one of them: thus the genus is closely allied to Tenthredo proper, rather than to Fenusa.

DOSYTHEUS *Leach.* DOLERUS p. *Hartig.* 14 sp. *T. Eglanteriæ* F.
Antennæ 9-jointed; body moderately long; two marginal and three submarginal cells, the first very short; third joint of antennæ longer than the fourth. Panz. 82. 11.

DOLERUS *Leach.* DOLERUS p. *Hartig.* 9 sp. *T. nigra* Linn. Pz. 52. 11.
Differs from Dosytheus in the third and fourth joints of antennæ being of equal length.

EMPHYTUS *Leach., Hartig.* 24 sp. *T. cincta* Linn. Curt. 436.
Antennæ 9-jointed; third and fourth joints of equal length; two marginal and three submarginal cells; the first as long as the second; hind wings with no middle cell.

(ANEUGMENUS *Hartig.* (Sect. of Emphytus.) 1 sp. *Emph. coronatus* Kl., St.
Body short, oval; hind wings with two middle cells.)

(? HARPIPHORUS *Hartig.* SELANDRIA p. *Steph.*? 1 sp. *Sel. scapularis* St. (*lepidus* Kl.?).

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* *Obs.* Hartig regards this as a subgenus of the genus Tenthredo (which also includes Selandria, Athalia, Macrophya, and Allantus, as subgenera), and divides it into six named sections: —

1. *Taxonus* Meg., which includes the following British species: T. agilis *Kl.*; T. nitidus *Kl.*; T. bicolor *Kl.*
2. *Strongylogaster* H.: Br. sp. T. cingulata *Fab.* Curt. 692.
3. *Pœcilostoma* H.: Br. sp. T. impressa *Kl., Steph.* (Emphytus).
4. *Perineura* H.: Br. sp. T. Rubi *Panz., Steph. Ill.*
5. *Tenthredo:* Br. sp. T. nassata *Linn.*; T. Coquebertii *Kl.*; T. dimidiata *Kl.*; T. aucupariæ *Kl.*; T. mandibularis *Kl.*; and many other species placed by Stephens both in Allantus and Tenthredo; and
6. *Synairema* H. (T. delicatula *Kl.*, not British.)

MELICERTA *Steph.* ——— 1 sp. *M. ochroleucus* St.

Antennæ 9-jointed; third joint longer than the fourth; two marginal, three submarginal cells, the first not shorter than the second.

HETERARTHRUS *Steph.* PHYLLOTOMA* *Fall.* 1 sp. *T. ochropoda* Kl.

Antennæ 11 to 15-jointed, third joint twice as long as the fourth; two marginal and four submarginal cells; the veins between the basal ones interrupted.

FENELLA *Westw.* ——— 1 sp. *F. nigrita* Westw.†

Antennæ 11-jointed, slender; two marginal, three equal-sized submarginal cells; first and second receiving a recurrent nerve.

FENUSA *Leach.* EMPHYTUS (*F.*) *Hartig.* 3 sp. *T. pumila* Kl.

Antennæ 9-jointed, slightly clavate; two marginal and three equal-sized submarginal cells; the first and second receiving one recurrent nerve; body short, stout.

DRUIDA *Newm.* Ent. Mag. vol. iv. 261.; v. 484. 1 sp. *D. parviceps* Newm.

Antennæ filiform, 10-jointed; first and second joints minute, third long, fourth rather shorter, remainder gradually decreasing; two marginal, three submarginal cells; first and second receiving a recurrent nerve.

MESSA *Leach.* FENUSA p. *Hartig.* 1 sp. *T. hortulana* Kl.

Antennæ 9-jointed; first and second joints short, third elongate, remainder decreasing; one marginal, and four submarginal cells.

NEMATUS *Leach.* TENTHREDO p. *Linn.* 40 sp. (*St.*) *T. Capreæ* Fab.

Antennæ 9-jointed; one marginal, four submarginal cells; the second receiving two recurrent nerves; tarsi simple. Panz. 65. 8.

CRÆSUS *Leach.* NEMATUS p. *Jur.* 3 sp. *T. septentrionalis* Linn. Curt. 17.

Antennæ 9-jointed; one marginal, four submarginal cells, the second receiving two recurrent nerves; basal joints of posterior tarsi greatly dilated.

EUURA *Newm.* PRISTIPHORA†† *St. Farg.* Cryptocampus *Hartig* (1?) *P. atra* Jur. tab. 6.

Antennæ 9-jointed, simple; one marginal, three submarginal cells; first very small; second very long, receiving two recurrent nerves.

PRISTIPHORA *Latr.* PRIOPHORUS *Dhlb.*? 6 sp. *T. Myosotidis* Fab.

Antennæ 9-jointed, simple; one marginal, three submarginal cells; the first large, receiving two recurrent nerves; the second small. Pz. 98. 13.

TRICHIOCAMPUS *Hartig.* NEMATUS p. *Steph.*, *St. Farg.* (5?) *N. grandis* St. Farg. Steph. pl. 38. f. 1.

Antennæ 9-jointed; ♂ with the base of the third joint dilated, pilose; one marginal and three submarginal cells of nearly equal size; the first and second receiving a recurrent nerve.

CLADIUS *Leach.* PTERONUS p. *Jur.* 1 sp. *Cl. difformis* Leach. Pz. 62. 10.

Antennæ 9-jointed, pectinated in ♂; one marginal, three nearly equal submarginal cells; first and second receiving a recurrent nerve.

Subfamily 4. *Lydides* Westw.

LOPHYRUS *Latr.* PTERONUS *Jur.* 3 sp. *T. Pini* Linn. Curt. 54.

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* I have not adopted this name in the restricted sense in which it is used by Dahlbom and Hartig, having been employed by Fallen for all the short-bodied Tenthredinides with short antennæ; the species of Athalia being its types. (*Fall. Mon. Tenthre. Suc.* p. 27.) The species which Dahlbom gives were even doubtingly considered by Fallen to belong to the genus. I had generically named the only British species, Decatria, which Mr. Stephens has changed.

† Nigra, femorum apice, tibiis tarsisque obscure luteis, alis nigricantibus. (*Long.* 1 lin. *Exp. Alar.* 3 lin.)

Antennæ multiarticulate, with two rows of pectinations in ♂; upper wings with one marginal cell.

? MONOCTENUS *Dhlb.* LOPHYRUS *Steph.* 1 sp. *T. Juniperi* Linn. Pz. 76. 11.
Antennæ multiarticulate, with one row of pectinations in ♂; upper wings with one marginal cell.

TARPA *Fabr.* MEGALODONTES *Latr.* 2 sp. *T. Cephalotes* Fab. Pz. 62. 7, 8.
Antennæ 15-to 18-jointed; upper wings with two marginal and four submarginal cells.

LYDA *Fab.* PAMPHILIUS *Latr.* 22 sp. *T. sylvatica* Linn. Curt. 381.
Antennæ 19-to 36-jointed, slender, setaceous; two marginal, and four submarginal cells; four hind tibiæ with three spurs.

Subfamily 5. *Cephides* Westw., (*Cephidæ* Hal.)

CEPHUS *Latr.* ASTATUS *Kl.* 11 sp. *Sirex pygmæus* Linn. Panz. 73. 17.
Antennæ subclavate, about 21-jointed; abdomen compressed.

JANUS *Stephens.* CEPHUS p. *Curt.* 2 sp. *J. connectens* St. Steph. pl. 36. f. 1.
Antennæ filiform; abdomen shorter than in Cephus, cylindric and subclavate.

PHYLLŒCUS *Newm.* ——— 1 sp. *P. Faunus* Newm.
Antennæ slightly thickened beyond the middle, 27-jointed; abdomen compressed.

Subfamily 6. *Xyelides* Westw. (*Xyelidæ* Hal.)

XYELA *Dalm.* PINICOLA *Latr.* 1 sp. *K. pusilla* Dalm. Curt. 30.
Antennæ with the third joint greatly elongated; ovipositor exserted, nearly as long as the abdomen.

Tribe 2. *Terebellifera* St. Farg. *Urocerata* Latr., Hal.; consisting of the single

Family *UROCERIDÆ* Leach. (Siricidæ *Curtis.*)

XIPHYDRIA *Latr.* HYBONOTUS *Klug.* 2 sp. *Sirex dromedarius* Linn.
Prothorax elongated into a neck; two marginal, and four submarginal cells; max. palpi long, 5-jointed. My fig. 72. 4.

UROCERUS *Geoff.* SIREX *Linn.* 7 sp. *S. gigas* Linn. Curt. 253.
Prothorax not forming a neck; two marginal, and four submarginal cells; max. palpi exceedingly short; ovipositor forming a long exserted borer.

(Subfamily ? *Oryssides* Westw. *Oryssidæ* Hal.)

ORYSSUS *Latr.* SPHEX p. *Scop.* 1 sp. *O. coronatus* Latr. Curt. 460.
Cylindrical; antennæ ♂ 11-jointed, ♀ 10-jointed; max. palpi long, 5-jointed; ovipositor spiral, capillary. (My fig. 73. 1.)

Subsect. 2. *Entomophaga* Westw. (Pupivora *Latr. Terebellifera** Hal.)

Tribe 1. *Spiculifera* Westw. (Terebellifera & Canalifera *St. Farg.*)

Family 1. *CYNIPIDÆ* Westw. (Diplolepidæ *Leach.* Gallicolæ *Latr., Hal.*)

IBALIA *Latr.* SAGARIS *Pz.* 1 sp. *Ib. Cultellator* Latr. Curt. 22.
Abdomen knife-shape; antennæ ♂ 15-, ♀ 13-jointed.

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* Mr. Haliday divides the petiolated terebrant Hymenoptera into five tribes: 1. *Entomotilla* (Ichneumonidæ, Stephanidæ, Evaniadæ). 2. *Oxyura* (Proctotrupidæ, Pelecinidæ, Diapriadæ, Scelionidæ, Ceraphronidæ). 3. *Gallicolæ* (Cyniphidæ). 4. *Halticoptera* (Leucospidæ, Chalcididæ, Mymaridæ). 5. *Tubulifera* (Chrysididæ).

CYNIPS *Linn.* ——— 33 sp. (*Curt.*) *C. quercus folii.* Linn. My fig. 73. 12.
Abdomen obovate; antennæ ♂ 15-, ♀ 14-jointed; wings large, with a small distinct triangular submarginal cell enclosed by nerves of equal thickness.

BIORHIZA *Westw.* CYNIPS p. *Fab.* 1 sp. *C. aptera Fab.* Coqueb. tab. 1. f. 11.
Abdomen obovate; antennæ ♀ 14-jointed; wings obsolete.

FIGITES *Latr.* EUCHARIS p. *Panz.* 12 sp. *F. scutellaris* Rossi.
Antennæ ♂ long, filiform, 14-jointed, ♀ shorter, thickened to the tips, 13-jointed; second submarginal cell triangular, with its basal nerve almost obsolete; scutellum large, with two basal excavations obtuse at the tip. Guérin, Icon R. An. t. lxvii. fig. 3.

ONYCHIA *Hal.* 1 sp. *Cynips biusta* sp. ined.
"Abdomen with the third segment very large concealing the posterior ones, petiole very short; scutellum channelled throughout; antennæ filiform, 14-joints ♂, 13 ♀; cubital areolets three, subcostal nerve not continued to join the rib.

"N.B. Cynips ediogaster *Pz.* does not belong to this group, but probably to *Figites.*" Haliday MSS.

EUCOILA *Westw.* ——— 5 sp. *E. crassinerva* Westw.
Antennæ ♂ 15-jointed, ♀ 13-jointed, short, gradually incrassated; second submarginal cell obliterated; scutellum with three excavations. Mag. N. H. vol. viii. p. 174.

KLEIDOTOMA *Westw.* ——— 3 sp. *Kl. Psiloides,* Westw.
Antennæ ♀ 13-jointed, short, three terminal joints suddenly thick; second submarginal cell obliterated; scutellum at the base with a broad excavation, with the apex tubercular, and 1-excavated.

ANACHARIS *Dalm.* ——— 5 sp. *An Eucharioides* Dalm.
Antennæ ♂ 14-jointed, ♀ 13-jointed, long, filiform; second submarginal cell obliterated; scutellum with two rudimental excavations; abdominal peduncle long. Steph. pl. 47. f. 1.

ŒGILIPS *Hal.* ANACHARIS B. *Westw.* 4 sp. *Cynips nitidula* Dalm.
"Abdomen globose-ovate; petiole short, cylindric, rugose; scutellum pyramidal, acute; antennæ filiform, 14-joints ♂, 13 ♀; cubital areolets two, indistinct, the anastomosis forming a callous dot." Haliday MSS.

ALLOTRIA *Westw.* ——— 1 sp. *Al. victrix,* Westw.
Antennæ ♀ 13-jointed, filiform, longer than the body; abdomen subsessile; second submarginal cell obliterated; scutellum transversely depressed at the base.

MELANIPS *Hal.* ——— 2 sp. *Cynips urticæ* Kirby.
"Abdomen somewhat acute in ♀, petiole very short; annular, second and third segments equal; scutellum rugose, the base bifoveolate; antennæ filiform, ♂ 14, ♀ 13-joints; cubital areolets three." Haliday MSS.

Family 2. *EVANIIDÆ* Westw. (Evaniadæ *Leach, Hal.*)

EVANIA *Fab.* SPHEX p. *Linn.* 1 sp. *Sp. appendigaster* Linn. My fig. 74. 1.
Abdomen minute, petiolated; fore wings with distinct discoidal cells; ovipositor not exserted.

BRACHYGASTER *Leach.* EVANIA p. *Curtis.* 2 sp. *E. minuta* Oliv. Curt. 257.
Abdomen minute, petiolated; fore wings without discoidal cells; ovipositor not exserted.

FŒNUS *Fab.* GASTERUPTRON *Latr. olim.* 2 sp. *Ichn. Jaculator* Linn. Curt. 423.
Abdomen long, gradually clavate; ovipositor long, exserted.

Family 3. *ICHNEUMONIDÆ* Leach. (*Hal.* Entomotilla *Dum.*)

Subfamily 1. *Ichneumonides* Westw. (Ichneumones genuini *Grav.*)

ICHNEUMON *Linn., Grav.* ——— 224 sp. *I. comitator* Linn.

Abdomen oblong-ovate, basal segment rough; ovipositor not exserted; scutellum flat; antennæ simple; outer cell complete; areolet distinct, 5-sided. Curtis 728.

STILPNUS *Grav.* ——— 5 sp. *S. gagates* Gr. Curtis, 388.

Outer cell incomplete; areolet distinct, 5-sided; abdomen ovate, depressed, very shining, basal segment linear; ovipositor not exserted; scutellum flat; antennæ simple.

ISCHNUS *Grav.* ——— 3 sp. *I. porrectorius* Fab.

Abdomen subcylindrical, smooth; petiole linear; antennæ simple; areolet 5-sided; ovipositor very short; scutellum flat.

BRACHYPTERUS *Gr.* ——— 1 sp. *B. means* Gr. Steph. pl. 40. f. 2.

Wings very short; areolet wanting; abdomen oblong-ovate; antennæ simple ovipositor scarcely exserted.

MICROLEPTES *Gr.* ——— 1 sp. *M. splendidulus* Gr. St. pl. 40. f. 3.

Head subglobose; areolet wanting; abdomen robust, petiolated; legs and antennæ thickened; ovipostor not exserted.

ACRODACTYLA *Hal.* Barypus *Hal. MSS., Curt. Guide.*, 2d ed. 2 sp. *B. degener* Hal.

Abdomen attenuated at the base, intermediate segments obsoletely compressed; anus ♀ slit; ovipositor exserted, short; areolet wanting; tarsi thick at tip; ungues lobed beneath.

MESOLEPTUS *Grav.* Ichneumon p. *Fab.* 62 sp. *M. narrator* Gr. Curt., 644.

Abdomen smooth, shining, with a long petiole; ovipositor not exserted, areolet wanting or very small, legs and antennæ slender.

TRYPHON *Fallen.* Ichneumon p. *Linn.* 99 sp. *T. rutilator*, Linn. Curt. 399.

Posterior tarsi slender; face flat; abdomen oblong, subsessile; ovipositor not exserted; scutellum flat; areolet subobsolete, triangular or suborbicular; antennæ slender or moderate; legs moderate.

CTENISCUS *Hal. MSS., Curt. Guide*, 2d ed. ——— 3 sp. *C. Curtisii* Hal.

Characters of Tryphon, but with the fore tibiæ one-spurred, intermediate one-spurred, and posterior without spurs.

EXOCHUS *Gr.* Hypsicera *Latr. R. An.* 19 sp. *E. antiquus* Gr.

Face with a frontal tubercle, abdomen subsessile, oblong-cylindrical; areolet obsolete, or small and triangular; ovipositor not exserted; scutellum flat; legs short and thick.

PERIOPE *Hal.* ——— 1 sp. *P. auscultator* Hal.

Abdomen subpetiolated, compressed at tip, elongate, fusiform; ovipositor concealed; thorax and antennæ very short; face protuberant; legs short; spurs 1. 2. 1.; ungues denticulated; areolet minute, subtriangular.

SCOLOBATES *Gr.* ——— 1 sp. *S. crassitarsus* Gr.

Posterior tarsi thickened; face flat; abdomen subsessile; basal segment gradually narrowed; ovipositor not exserted; scutellum flat; areolet wanting.

SPHECOPHAGA *Westw.* Anomalon p. *Curt. nec Jur. Grav.* 1 sp. *A. vesparum*

Hind legs robust; abdomen sessile, broadly ovate; ovipositor not exserted; areolet wanting. Curt. 198.

TROGUS *Panzer.* ICHNEUMON *Curt.* 8 sp. *Tr. alboguttatus* Gr. Curt. 234.
Scutellum elevated; head transverse; ovipositor not exserted; areolet 3- or 5-sided; abdomen petiolated, convex.

ALOMYA *Panzer.* ICHNEUMON p. *Linn.* 3 sp. *A. ovator* F. Curt. 120.
Head globose; areolet triangular; abdomen long, petiolated, depressed; antennæ short ♀.

HOPLISMENUS *Gr.* ——— 5 sp. *H. mœstus* Gr.
Head transverse; metathorax acutely spined; legs and antennæ slender and simple; areolet pentagonal; abdomen oblong, petiolated; basal segment with two elevated lines; ovipositor short; scutellum flat.

CRYPTUS *Fab.* ICHNEUMON *Linn.* 51 sp. *C. viduatorius* F. Curtis, 668.
Ovipositor long; metathorax unarmed; legs and antennæ slender and simple; areolet 4- or 5-sided; abdomen petiolated, ovate, convex; head transverse.

PHYGADEUON *Gr.* ICHNEUMON p. *Schr.* 25 sp. *Ph. flavimanus* Gr.
Legs and antennæ somewhat thickened and simple; areolet pentagonal, small; abdomen petiolated; ovipositor exserted, moderately long.

MESOSTENUS *Gr.* ——— 2 sp. *M. transfuga* Gr.
Areolet minute, quadrate; antennæ simple; abdomen petiolated; ovipositor exserted, long, or moderate; scutellum flat.

HEMITELES *Gr.* ——— 13 sp. *H. tristator* Gr. Pz. 94. 14.
Areolet small, incomplete, pentagonal, or obsolete; antennæ simple; abdomen petiolated; ovipositor exserted, long; scutellum flat.

AGRIOTYPUS *Walk.* ——— 1 sp. *A. armatus* Wlk. Curtis, 389.
Scutellum with a long acute spine; abdominal peduncle long, slender, curved; abdomen thick, oval; second and third segments coalescing; areolet wanting; ovipositor not exserted.

PEZOMACHUS *Gr.* GELIS *Thunb.* 21 sp. *P. aberrans* Gr. Curtis, 536.
Abdomen petiolated; ovipositor exserted, short, or moderate; wings rudimental, not fitted for flight.

PHYTODIETUS *Gr.* ——— 3 sp. *P. astutus* Gr.
Abdomen subsessile, or subpetiolated; inferior nerve of the inner cell angulated; ovipositor exserted; scutellum flat; areolet obsolete, or triangular.
Obs. Stephens introduces Gravenhorst's Ischnocerus into his table of this family; but the British species are not yet indicated.

MESOCHORUS *Gr.* ——— 10 sp. *M. Tipularius* Gr. Curtis, 464.
Areolet large, rhomboidal; antennæ simple; abdomen petiolated, oblong; ovipositor exserted, short; scutellum flat; head transverse; anus ♂ often appendiculated.

PLECTISCUS *Gr.* ——— 3 sp. *P. impurator* Gr.
Abdomen subsessile, or subpetiolated; inferior nerve of the inner cell straight; wings fitted for flight; ovipositor exserted; scutellum flat; areolet obsolete or oblique.

HELICTES *Hal. MSS., Curt. G.* 2d ed. 5 sp. *P. erythrostoma* Gm.
Abdomen petiolated; first segment attenuated; ovipositor concealed or subexserted; antennæ slender, convoluted; areolet wanting; legs slender, posterior pair rather long.

GLYPTA *Gr.* ——— 6 sp. *G. sculpturata* Gr.
Areolet wanting; abdomen shining; intermediate segments of abdomen with two oblique lines, deeply incised or tubercled; abdomen sessile, convex; ovipositor exserted, long.

LAMPRONOTA *Curt.* LISSONOTA *Grav.* 19 sp. *I. setosus* Fourc. Curt. 407.
Thorax smooth; abdomen shining, with smooth segments; terminal ventral segments entire ♀; scutellum triangular; areolet obsolete or triangular; ovipositor long.

Obs. Stephens (Tab. Ichneumonidæ, vol. vii. p. 126.) has indicated a genus next to Lampronota, which he names Stilbonota, having the antennæ not crenulated; whereas he characterises Lampronota by crenulate antennæ. The species of the former are not yet indicated.

POLYSPHINCTA *Gr.* ——— 4 sp. *P. tuberosa* Gr.
Abdomen shining, sessile, with transverse impressions, ♀ with the apex slit beneath; legs rather slender; areolet wanting; thorax smooth; ovipositor exserted, short, or moderate.

SCHIZOPYGA *Gr.* ——— 2 sp. *S. podagrica* Gr.
Abdomen shining, sessile, convex; segments with transverse impressions, the two terminal ventral ones slit in ♀; legs thickened; thorax smooth; areolet wanting; ovipositor exserted; very short.

CLISTOPYGA *Gr.* ——— 1 sp. *C. incitator* Fab.
Abdomen shining, sessile, convex; segments tubercled; apex entire beneath ♀; thorax smooth; areolet wanting; ovipositor exserted, moderate; legs moderate.

PIMPLA *Fab.* ICHNEUMON. p. *Linn.* 16 sp. *P. flavicans* F., Curtis, 214.
Abdomen sessile, convex, shining; segments tubercled, the intermediate transverse; areolet distinct, triangular; thorax smooth; ovipositor exserted, moderate, or long.

EPHIALTES *Gr.* ——— 7 sp. *I. manifestator* Linn. Pz. 19. 21.
Abdomen sessile, convex, shining; segments tubercled, the intermediate elongated; areolet distinct, triangular; thorax smooth; ovipositor long.

RHYSSA *Gr.* ——— 1 sp. *R. persuasoria* L. Pz. 19. 19.
Abdomen long, sessile, convex, shining, terminal ventral segments slit ♀; thorax transversely rugulose; ovipositor very long; areolet triangular.

Obs. Stephens (Tab. Ichneumonidæ, vol. vii. p. 126.) introduces Gravenhorst's Trachyderma in this place; but as the British species are not yet indicated, I cannot give an example.

PELTASTES *Illiger.* METOPIUS *Gr.* 3 sp. *P. dissectorius.* Pz. Curtis, 4.
Abdomen sessile, depressed, rough; scutellum transverse, quadrangular, apical angles acute; ovipositor not exserted.

BASSUS *Fab.* S. P. *Grav.* (nec *Curt.*) ——— 12 sp. *B. lætatorius* Fab.
Abdomen sessile, depressed; the basal joint equilateral, flat; antennæ simple; legs rather slender; areolet obsolete or triangular; ovipositor scarcely exserted. Pz. 19. 19.

ORTHOCENTRUS *Gr.* ——— 7 sp. *O. anomalus* Gr.
Abdomen sessile, depressed; basal joint equilateral, flat; antennæ simple; legs thickened; areolet generally 5-sided; ovipositor scarcely exserted.

EUMESIUS *Westw.* EUCEROS *Grav.* 3 sp. *E. crassicornis* Gr. Curt. 660.
Antennæ dilated in the middle; areolet wanting; segments of abdomen constricted.

BANCHUS *Fab.* ICHNEUMON p. *Linn.* 5 sp. *B. venator* Fab. Curtis, 588.
Abdomen sessile, compressed; areolet distinct, large, square; inferior outer nerve of the inner cell subarcuate; ovipositor concealed.

EXETASTES *Gr.* ——— 6 sp. *E. fornicator* Fab.

Abdomen subpetiolated, compressed; areolet distinct, large, square; inferior outer nerve of the inner cell angulated or triangular; ovipositor short.

COLEOCENTRUS *Gr.* ——— 1 sp. *C. excitator* Pz.? Pz. 92. 5.

Areolet distinct, small, triangular; abdomen compressed at the tip, subsessile, ♀ with a plough-shaped anal valve; ovipositor long.

AROTES *Gr.* ——— 1 sp. *A. albicinctus* Gr.

Areolet wanting; hind legs thick; abdomen compressed at the apex; subpetiolated; females with a plough-shaped anal valve; ovipositor long.

CAMPOPLEX *Gr.* ——— 1 sp. *C. difformis* Gr. Pz. 100. 15.

Areolet triangular or wanting; abdomen petiolated, subcompressed; inner cell with one recurrent nerve; radial cell narrow, sublanceolate; femora and tarsi slender; ovipositor short or moderate.

PANISCUS *Schrank Grav.* ——— 4 sp. *I. virgatus* Fourc. Pz., Sch. 82. 3.

Abdomen quite compressed, petiolated, basal segment conical; areolet triangular; inner cell with one recurrent nerve; radial cell narrow, sublanceolate; legs and antennæ rather slender; ovipositor short.

THERION *Curt.* ANOMALON *Gr.* 10 sp. *I. enecator* Ross. Pz., Sch. 225. 4.?

Posterior tarsi thickened; femora simple; abdomen compressed, petiolated; areolet wanting; ovipositor short.

OPHION *Fab.* ANOMALON *Jur.* 5 sp. *I. luteus* L. Curtis, 600.

Thorax smooth; inner cell with two recurrent nerves; radial cell narrow, lanceolate; tarsi and femora slender; abdomen very compressed, sickle-shaped; areolet wanting; ovipositor scarcely exserted.

Obs. Stephens (Tab. Ichneumonidæ, vol. vii. p. 126.) indicates a genus next to Ophion, which he names Enicospilus, differing from Ophion in having the first submarginal cell spotted. His pl. 40. fig. 4. is evidently intended for a species of this genius, of which the species are not yet indicated.

TRACHYNOTUS *Gr.* ——— 1 sp. *T. foliator* F.

Thorax rough; inner cell with two recurrent nerves; radial cell narrow, lanceolate; tarsi and femora simple; abdomen petiolated, long, compressed at the tip; areolet wanting; ovipositor short.

PACHYMERUS *Gr.* ——— 1 sp. *P. calcitrator* G. Curtis, 624.

Hind femora thickened, not spined; abdomen compressed, petiolated; areolet wanting; ovipositor long; stigma long.

PRISTOMERUS *Curt.* ——— 1 sp. *P. vulnerator* Pz. Curtis, 624.

Hind femora thickened and spined; abdomen compressed, petiolated; areolet wanting; ovipositor moderate; stigma large.

CREMASTUS *Gr.* ——— 3 sp. *C. spectator* Gr.

Areolet wanting; abdomen very compressed and petiolated; inner cell with one recurrent nerve; radial cell narrow, sublanceolate; tarsi and femora simple; antennæ and legs slender; ovipositor moderate.

PORIZON *Fall* ——— 7 sp. *P. nutritor* F.

Radial cell very large and triangular; femora and tarsi simple; abdomen compressed, petiolated; stigma large; areolet wanting; ovipositor curved.

ATRACTODES *Gr.* ——— 12 sp. *A. bicolor* Gr.

Areolet pentagonal; abdomen subcompressed, petiolated; inner cell with one recurrent nerve; radial cell narrow; femora and tarsi simple; areolet 5-sided; ovipositor scarcely exserted.

ACOENITES *Latr.* ——— 1 sp. *A. dubitator* F. Pz. 78. 14.
Hind legs long and thick; scutellum flat; head transverse; abdomen subsessile.

XYLONOMUS *Grav.* Ichneumon p. *Fab.* 4 sp. *X. pilicornis* Gr. Curt. 353.
Face quadrate; areolet wanting; femora simple; head globose; abdomen sessile, depressed, rough, and lineated at the base; ovipositor moderate or long.

XORIDES *Latr.* ——— 5 sp. *X. nitens* Gr.
Face narrowed towards the mouth; areolet wanting; femora simple; head globose; abdomen subsessile; ovipositor long.

CLEPTICUS *Hal.* ——— 4 sp.? *Cryptus prætor* Hal.
Abdomen peduncled; first segment tubercled; clypeus compressed at the base, semicircular; antennæ and legs slender; areolet wanting; ovipositor exserted.

ODONTOMERUS *Gr.* ——— 2 sp. *O. dentipes* Gr.
Hind femora very thick and toothed; areolet wanting; head globose; abdomen petiolated, clavate; ovipositor long.

ECTHRUS *Gr.* ——— 1 sp. *I. reluctator* L. Pz. 71. 13.
Areolet pentagonal or wanting; femora simple; head globose; abdomen subpetiolated; ovipositor long.

Subfamily 2. *Braconides* Westw. (Ichneumones Adsciti *Esenb.**)

Division 1. Polymorphi *Wesm.*

OPIUS *Wesm.* Bracon p. *Nees.* 50 sp. *Bracon carbonarius* Nees.
Clypeus remote from the mandibles or lower wings with a disco-recurrent nerve or stigma elongate attenuate; three cubital areolets, second oblong. Wesm. t. 2. f. 5—12.

GNAMPTODON *Hal.* Diraphus *Wesm.* 1 sp. *Bracon pumilio* Nees.
Clypeus remote from the mandibles; borer short, inflected; three cubital areolets, second transverse.

METEORUS *Hal.* { Perilitus *Wesm.* / Zele *Curtis* p. } 22 sp. *Ichneumon pendulator* Latr.
Abdomen petiolate; borer exserted; three cubital areolets. Curt. BE. 415.

MICROCTONUS *Wesm.* Perilitus p. *Hal.* 3 sp. *Per. idalius* Hal.
Abdomen petiolate; borer exserted; antennæ straight; two cubital areolets; mesothoracic scutum levigate. Wesm. t. 1. f. 6.

PERILITUS *Nees.* Microctonus p. *Wesm.* 8 sp. *Per. rutilus* Nees.
Abdomen petiolate; borer exserted; antennæ straight; two cubital areolets; parapsides of mesothorax distinct. Wesm. t. 1. f. 7 8.

ROPALOPHORUS, N.G. *Hal.* Microctonus p. *Wesm.* 1 sp. *Micr. clavicornis* Wesm. Brac. Belg. pl. 3. f. M.
Abdomen petiolate; borer exserted; two cubital areolets; antennæ subclavate, slightly geniculate; scape cylindric, shorter than the head.

STREBLOCERA *Westw.* 1 sp. *Str. fulviceps* Westw.
Abdomen petiolate; borer exserted; two cubital areolets; antennæ geniculate; scape elongate, toothed below.

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* The value of the Generic Synopsis of the Ichneumones Adsciti will be duly appreciated when the reader is informed that it has been kindly communicated to me by A. H. Haliday, Esq., whose memoirs upon this tribe, published in the *Entomological*, afford so good an example of descriptive entomology.

EUPHORUS *Nees.* Leiophron *BE.* 11 sp. *L. pallipes* Curt. BE. 476.
Abdomen petiolate; borer concealed; two cubital areolets; radial areolet very short, semilunate.

CENTISTES *Hal.* Leiophron p. *Wesm.* 4 sp. *Bracon lucidator* Nees.
Abdomen subsessile; borer short, inflected; two cubital areolets; mesothoracic scutum levigate. Wesm. t. 2. f. 2.

LEIOPHRON *Nees.* Ancylus *Hal.* 5 sp. *L. ater* Nees.
Abdomen subsessile; borer short, incurved; two cubital areolets; sutures of parapsides distinct.

PYGOSTOLUS *Hal.* Blacus p. *Wesm.* 2 sp. *Cryptus sticticus* F.
Abdomen subsessile, the apex obtuse and gaping; borer deflected; two cubital areolets.

GANYCHORUS *Hal.* Blacus p. *Wesm.* 7 sp. *Bracon ruficornis* Nees.
Abdomen subpetiolate; borer exserted; head subglobose; two cubital areolets; ungues of anterior feet appendiculate. Berl. Mag. v. tab. 1. f. 3.

BLACUS *Nees.* Bracon p. *Nees olim.* 8 sp. *Bracon humilis* Nees.
Abdomen subsessile, compressed; borer exserted; head subglobose; two cubital areolets; ungues simple. Berl. Mag. v. tab. 1. f. 4. *a, b, c.*

EUBADIZON *Nees.* ——— 3 sp. *Eub. pectoralis Nees.* Wesm. t. 2. f. 3.
Abdomen subsessile, with distinct segments; borer elongate; head transverse; occiput truncated; two cubital areolets.

CALYPTUS *Hal.* Brachistes *Wesm.* 4 sp. *Eubazus macrocephalus* Nees.
Abdomen subsessile, with three segments only apparent; borer elongate; two cubital areolets. Wesm. t. 2. f. 4.

ORGILUS *Hal.* Ischius *Wesm.* 1 sp. *Microdus obscurator* Nees.
Abdomen subsessile; borer exserted; occiput concave; hind legs stout, with large spurs; two cubital areolets, radial narrow, cuneate. Berl. Mag. 6. tab. 4. f. 1.

DIOSPILUS *Hal.* Taphæus *Wesm.* 2 sp. *Diosp. speculator* Hal.
Abdomen subsessile; borer exserted; three cubital areolets, second transverse or subquadrate, prædiscoidal areolet contiguous; clypeus obtuse. Wesm. tab. 2. f. 18.

ASPIGONUS *Wesm.* Bracon p. *Nees.* 1 sp. *Asp. diversicornis* Wesm.
Abdomen subsessile; borer exserted; three cubital areolets, second subquadrate; prædiscoidal areolet contiguous; clypeus angulate. Wesm. t. 2. f. 16. t. 3. f. 0.

HELCON *Nees.* Pimpla p. F. 1 sp. *Helcon tardator* Nees.
Abdomen subsessile; borer elongate; front mucronated; hind legs elongate, with incrassate thighs; three cubital areolets. Nees, Berl. Mag. 6. tab. 4. f. 6.

MACROCENTRUS *Curt.* Rogas *Wesm.* 7 sp. *Cryptus abdominalis* F.
Abdomen subsessile; borer elongate; head transversely compressed; three cubital areolets; divisions of mesothoracic scutum protuberant. Nees, Berl. Mag. v. t. 1. f. 1.

PHYLAX *Wesm.* Zele p. *Curt.* 4 sp. *Zele testaceator* Curt.
Abdomen subsessile, falcate; borer short; three cubital areolets, second oblong. B.E. 415. f. 1—6. Wesm. t. 2. f. 13.

DYSCOLETES, N.G. Dyscolus *Hal.* (g. Coleopt.) 1 sp. *D. lancifer*, sp. ined.
Abdomen subsessile; borer elongate; three cubital areolets, second trapezoid, receiving the recurrent nerve.

CENOCŒLIUS, N.G. ——— 1 sp. *Cen. flavifrons*, sp. ined.

Abdomen subsessile; three cubital areolets; prædiscoidal areolet distinct from the costa; clypeus obtusely angled.

ICHNEUTES *Nees.* ——— 1 sp. *S. reunitor* Nees.

Abdomen subsessile, spathulate; borer concealed; three cubital areolets, second attenuate at the apex; radial triangular; radius of lower wings obliterated. Berl. Mag. vol. vii. tab. 7. f. 3.

PROTEROPS *Wesm.* Bracon p. *Curt.* 1 sp. *Pr. nigripennis* Wesm. B.E. 69.

Abdomen subsessile, obovate; borer concealed; antennæ close to the vertex; three cubital areolets, second short; radial triangular, rounded.

PAXYLLOMA *Bubisson* { Plancus *Curt.* / Hybrizon *Fallen.* } 1 sp. *P. buccata* Br.

One long marginal cell, two submarginal cells, the second lanceolate, pointed at base; abdomen with a long 2-jointed peduncle; basal joint of posterior tarsi dilated. My fig. 74. 18.

Division 2. Cryptogastri *Wesm.*

SIGALPHUS *Nees.* Triaspis *Hal.* 6 sp. *Sig. semirugosus* Nees.

Three cubital areolets; borer exserted. Berl. Mag. vol. vii. t. 7. f. 1 2.

CHELONUS *Jur.* Sigalphus p. *Latr.* 7 sp. *Cynips inanita* Linn.

Three cubital areolets, first incomplete; eyes hairy; segments of abdomen completely coalite. BE. 672.

ASCOGASTER *Wesm.* Chelonus p. *Nees.* 7 sp. *Sigalphus rufipes* Latr.

Three cubital areolets, second nearly triangular; eyes glabrous; segments of abdomen coalite. Nees, Berl. Mag. vol. vii. t. 7. f. 2.

PHANEROTOMA *Wesm.* Chelonus p. *Pz.* 1 sp. *Ch. dentatus* Pz. 88. 141.

Abdomen subdepressed, 3-jointed, with crenulated sutures; middle tibiæ sinuated; three cubital cells.

RHITIGASTER, *Wesm.* Sigalphus p. *Latr.* 1 sp. *Ichn. irrorator* F.

Three cubital areolets, second oblong; abdomen clavate; segments three, connate. Wesm. tab. 2. f.

Division 3. Areolarii *Wesm.*

AGATHIS *Latr.* Bracon p. *F.* 6 sp. *Ag. malvacearum* Latr.

Eyes glabrous; maxillæ and labium elongate; three cubital areolets, second very minute. Nees, Berl. Mag. vol. vi. tab. 4.

MICRODUS *Nees.* Bassus p. *F.* 5 sp. *Bassus calculator* Panz. BE. 73.

Eyes glabrous; mouth short; three cubital areolets, first incomplete; second very minute, triangular.

EARINUS, *Wesm.* { Microdus p. *Nees.* / Bassus p. *Curt.* } 4 sp. *Bassus gloriatorius* Pz. 100. 17.

Eyes glabrous; mouth short; three cubital areolets, first complete, second very minute, quadrangular.

MICROGASTER *Latr.* Vipio *Fall.* 60 sp. *Ichneumon glomeratus* Linn.

Eyes pilose; antennæ 18-jointed; cubital area contracted in the middle; areolets two or three, the intermediate being very minute; radial triangular, faintly traced. Curt. BE. 321.

ACÆLIUS *Hal.* Adelius *Wesm.* 1 sp. *Ac. subfasciatus* Hal.

Eyes pilose; antennæ 20-jointed; three first segments of abdomen coalite; radial areolet incomplete. Wesm. tab. 3. f. 7.

MIRAX *Hal.* ——— 1 sp. *M. Spartii.*
Antennæ 14-jointed; segments of abdomen distinct; radial areolet incomplete.

Division 4. Cyclostomi *Wesm.*

BRACON *Fabr.* VIPIO *Latr.* 30 sp. *Bracon desertor* F. Panz. 79. 10.
Second and third abdominal segments divided by a furrow; ventral valve acuminate; three cubital areolets; brachial areolets conterminous; lower wings with pobrachial areolet very minute; front even; third joint of antennæ longer than second.

COELOIDES *Wesm.* BRACON p. *Nees.* 1 sp. *Brac. initiator* Fab.
Front excavated; second and third joints of antennæ equal; basal joint of hind tarsi shorter than the following united; three cubital areolets; ovipositor long.

ROGAS *Nees.* { SCHIZODES *Wesm.* / ALEIODES *Wesm.* } 8 sp. *Bracon gasterator* Jur. Curt. 512.
Three anterior segments of abdomen nearly equal; second and third divided by a furrow, the rest very small; borer very short; three cubital areolets; Pobrachial areolet surpassing the anterior; lower wings with the vestige of a discorecurrent nerve.

ADEMON *Hal.* { ROGAS p. *Nees.* / OPIUS p. *Wesm.* 3. 148. } 1 sp. *Rog. descrescens* Nees.
Second and third abdominal segments divided by a furrow; borer very short; three cubital areolets; radial slightly incomplete; stigma very narrow. Berl. Mag. vol. v. t. 2. fig. 10.

CLINOCENTRUS *Hal.* EXOTHECUS p. *Wesm.* 4 sp. *Cl. umbratilis* Hal.
Abdomen with the three anterior segments large; second and third nearly coalite, the rest very short; borer shorter than the abdomen; three cubital areolets; anal nerve posterior.

COLASTES *Hal.* EXOTHECUS p. *Wesm.* 9 sp. *Col. braconius* Hal.
Abdomen with the segments nearly equal or gradually decreasing; second and third nearly coalite; borer shorter than abdomen; three cubital areolets; anal nerve posterior.

RHYSSALUS *Hal.* EXOTHECUS p. *Wesm.* 2 sp. *Rh. clavator* Hal.
Abdomen sub-sessile; borer longer than abdomen; head transverse; three cubital areolets.

DORYCTES *Hal.* ISCHIOGONUS *Wesm.* 5 sp. *Bracon striatellus* Nees.
Abdomen subsessile; second and third segments nearly coalite; head cubic; three cubital areolets.

HECABOLUS *BE.* ANISOPELMA *Wesm.* 1 sp. *H. sulcatus* BE. Curt. 507.
Abdomen subsessile; borer elongate; head cubic; two cubital areolets; lower wings of ♂ with a stigma.

HORMIUS *Nees.* Sect. 1. ——— 1 sp. *H. moniliatus* Nees.
Abdomen subsessile; antennæ of more than twelve joints; cubital areolets three; 1 nerve interstitial. Berl. Mag. vol. v. t. 2. fig. 11.

CHREMYLUS *Hal.* { PENECERUS *Wesm.* / HORMIUS p. *Nees.* } 1 sp. *Hormius rubiginosus* Nees.
Abdomen subsessile; antennæ 12-jointed; cubital areolets three; anal nerve interstitial.

SPATHIUS *Nees.* CRYPTUS p. *F.* 2 sp. *Cryptus clavatus* Panz. Panz. 102. 16.
Abdomen petiolate; head cubic; three cubital areolets.

Division 5. Exodontes *Wesm.*

ALYSIA *Latr.* Bassus *Nees*, olim. 60 sp. *Cryptus manducator* Panz. Curt. 141.
Three cubital areolets.

CHASMODON *Hal.* Alysia p. *Nees.* 1 sp. *Al. aptera* Nees.
No wings; thorax narrow.

ŒNONE *Hal.* Sigalphus *Nees*, Sect. 2. 3 sp. *Sig. mandibularis* Nees.
Two cubital areolets; abdomen ovate, rugose, with the segments connate or coalite.

DACNUSA *Hal.* Alysia *Nees*, Sect. 5. 25 sp. *Al. petiolata* Nees.
Two cubital areolets; stigma elongate, attenuate; eyes glabrous; abdomen smooth, except at the base; head transverse. Berl. Mag. vol. v. t. 1. fig. 5.

CHOREBUS *Hal.* Perilitus p. *Nees.* 4 sp. *Chor. nereidum* Hal.
Two cubital areolets; stigma elongate; eyes pilose; head transverse.

CHÆNUSA *Hal.* (Hym. Brit. Alys.) Perilitus p. *Nees.* *P. conjungens* Nees.
Two cubital areolets; stigma short; eyes villose; abdomen obovate, spatulate, subglabrous. Berl. Mag. vol. v. t. 2. fig. 7.

CŒLINIUS *Nees.* Chænon *B. E.* 8 sp. *Chænon anceps* B. E. Curt. 289.
Two cubital areolets; stigma short; head cubic; abdomen elongate, compressed in ♀.

Division 6. Flexiliventres *Westw.* (Fam. *Aphidiadæ* Steph. Subfam. *Aphidiadæ* Haliday MSS. Polymorphi p. *Wesm.*)

PRAON *Hal.* Blacus p. *Nees.* 5 sp. *Pr. dorsalis* Hal.
Prædiscoidal areolet complete; cubital open to the exterior margin. Wesm. Br. Belg. tab. 1. fig. 14.

EPHEDRUS *Hal.* Elassus *Wesm.* 4 sp. *Bracon plagiator* Nees.
Prædiscoidal areolet complete; cubital three; antennæ 11-jointed. Wesm. tab. 1. fig. 12.

TOXARES, *N. G.* Trionyx *Hal.* (g. of Reptiles.) 1 sp. *Tr. deltiger* Hal.
Prædiscoidal areolet complete; cubital three; antennæ of more than 11 joints.

MONOCTONUS *Hal.* ——— 3 sp. *M. nervosus* Hal.
Disco-cubital areolet short, hexagonal; stigma internally prolonged, attenuate.

TRIOXYS *Hal.* Aphidius p. *Wesm.* 12 sp. *Tr. aceris* Hal. Curt. 383.
Disco-cubital areolet obliterated; stigma triangular; radius arched, abbreviated; ventral valve of ♀ with two spines.

APHIDIUS *Nees.* Hybrizon *Fab.* 29. sp. *Ichn. aphidum* L.
Disco-cubital areolet attenuate externally.; stigma triangular or lanceolate; ventral valve unarmed. (Rarely apterous.) Nees, Berl. Mag. vol. v. t. 2. f. 8.

Family 5. *CHALCIDIDÆ* Westw. (Cympsera *Latr.* Diplolepariæ *Spin.* Pteromalini *Dalm.* Halticoptera *Hal.*)

Subfamily 1. *Chalcides* Westw.

CHALCIS *Fab.* Smiera *Spinola, Curt.* 3 sp. *Sph. sispes* Linn. Curt. 472.
Abdominal peduncle and posterior coxæ elongate; hind femora thickened and toothed; antennæ inserted near the middle of the face, 13-jointed, second joint small, third very minute, fourth as long as the following.

BRACHYMERIA *Westw.* CHALCIS *Curt., Spin.* 1 sp. *Ch. minuta* F. Pz. 32. 6.
Short, thick; antennæ short; abdomen subsessile, subconical, scarcely compressed; posterior coxæ not elongated; antennæ inserted near the middle of the face.

HOCKERIA *Laporte.* CHALCIS p. *Panz.* 2 sp. *Ch. armata* Panz.
Antennæ inserted near the mouth; abdominal peduncle very short; posterior tibiæ not acute at the tip; hind femora thick. Steph. pl. 44. f. 3.

HALTICHELLA *Spin.* CHALCIS p. *Fab.* 1 sp. *Ch. pusilla* Fab.
Antennæ inserted near the mouth, ♂ subfusiform, ♀ subclavate; posterior tibiæ acute at the tip; abdominal peduncle very short; hind femora thickened, and toothed beneath.

EUCHARIS *Latr.* ——— 1 sp. *Euch. adscendens* Fab.
Antennæ thick, moniliform; first and third joints long; palpi very minute; thorax gibbous; scutellum produced; abdominal peduncle long; legs simple. Steph. Ill. pl. 44. f. 1.

Subfamily 2. *Eurytomides* Westw.

EURYTOMA *Illig.* ——— 11 sp. *Eur. abrotani* Panz. Steph. pl. 45. f. 3.
Collar transverse-quadrate; abdomen compressed; antennæ ♂ setaceous, verticillate-pilose, 11-jointed; ♀ clavate, 12-jointed; max. palpi 4-jointed.

DECATOMA *Spin.* ——— 15 sp. *Pter. biguttatus* Swed. Curt. 345.
Abdomen compressed; antennæ ♂ and ♀ clavate, ♂ 11-jointed, ♀ 12-jointed, third and fourth joints minute; max. palpi 3-, labial 2-jointed.

SYSTOLE *Walk.* ——— 2 sp. *S. albipennis* Wlk.
Abdomen cylindric; body short, thick; antennæ ♀ acuminated at tip, 12-jointed, short, submoniliform; head large.

ISOSOMA *Walk.* ——— 26 sp. *Decat. longula* Dalm.
Abdomen cylindric; body elongate, slender; antennæ ♀ rounded at tip, 12-jointed, clavate; ♂ 11-jointed, pilose, filiform.

(Subfamily? *Spalangiides.*)

CEROCEPHALA *Westw.* EPIMACRUS *Walk.* 2 sp. *C. cornigera* Westw.
Head large, tricornuted in front; antennæ 10-jointed, third joint longer than the second and fourth, seven terminal joints nearly equal; collar triangular; peduncle nearly as long as abdomen. Steph. pl. 45. f. 1.

THEOCOLAX *Westw.* LAESTHIA *Hal.* 1 sp. *Th. formiciformis* Westw.
Apterous, or with very minute rudiments of wings; head subhorizontal, quadrate, very slightly tridentate in front; antennæ 11-jointed, second joint large, third to eighth gradually thicker, three terminal joints forming a mass; collar large, triangular; ovipositor short, exserted.

SPALANGIA *Latr.* ——— 3 sp. *Sp. nigra* Latr. Gen. t. 12. f. 7, 8.
Head ovate, narrowed in front; antennæ inserted close to the anterior margin of the head, 10-jointed; ♂ filiform, with the third joint long; ♀ thickened, the third to ninth joints short; collar attenuated; abdomen peduncled.

MACROGLENES *Westw.* ICHNEUMON *Kirby.* 1 sp. *Ich. penetrans* K.
Head broad; eyes very large; antennæ short, thick at the tip, 10-jointed in ♂, second joint moderate, third to fifth small, sixth as large as second, seventh larger, remainder forming a mass, 9-jointed in ♀; abdomen compressed; ovipositor slightly exserted; max. palpi 3-, labial 2-jointed.

PIRENE *Hal.* CORYNOCERE *Nees.* 5 sp. *P. varicornis* Hal.

Head ovate; mouth prominent; max. palpi 2-jointed, labial almost obsolete; eyes large; antennæ short, 10-jointed, second joint as large as the five following, which are minute, three terminal joints forming a very large club; collar transverse; abdomen subsessile, compressed.

Obs. "Notwithstanding the different palpi, this genus is too closely related to Macroglenes to admit of their separation in different subfamilies." — *Haliday MSS.*

ASAPHES *Walk.* CHRYSOLAMPUS p. *Esenb.* 1 sp. *As. vulgaris* Wlk.

Head transverse; mandibles 2-dentate; antennæ 12-jointed, clavate, third joint very minute, fourth and following short; collar large, subquadrate; abdomen ♂ ovate-convex; first and second joints very large, ♀ rather longer; wings narrow.

CEA *Hal.* ——— 1 sp. *C. pulicaria* Hal.

Head moderate, transverse, subquadrate; antennæ slender, filiform; third and following joints short, equal; thorax long-ovate; collar moderate; metathorax peduncle-like; abdomen long-ovate, compressed; ovipositor exserted; legs long, slender; wings 0.

Subfamily 3. *Pteromalides* Westw.

[1. Torymidæ *Wlk.*]

MEGASTIGMUS *Dalm.* DIPLOLEPIS p. *Fab.* 2 sp. *Dipl. dorsalis* Fab.

Stigma thickened; legs subequal; ovipositor long, exserted; abdomen ♂ petiolated; mesoscutellum convex; proscutellum elongate. Steph. Ill. 45. f. 2.

MONODONTOMERUS *Westw.* TORYMUS B. A. *Dalm.* 2 sp. *Dipl. stigma* Fab.

Collar large, transverse; hind femora thick, but not serrated, beneath armed with a tooth near the tip; mesoscutum with distinct sutures; antennæ with the third joint minute; club scarcely shorter than the two preceding joints.

Obs. Curtis, in his *Guide*, gives Priomerus *Wlk.* as British; it is, however, given by Walker as an inhabitant of the South of France. The posterior femora are thick and toothed, and the posterior tibiæ curved. Type, P. pachymerus *Wlk.*

DIOMORUS *Wlk.* ——— 1 sp. *D. nobilis* W.

Collar narrowed in front; abdomen elongate, ovate, sessile; ovipositor exserted, long; antennæ 13-jointed, subfiliform; hind femora thickened, with a spine near the tip; mesoscutum with distinct sutures.

CALLIMOME *Spin.* MISOCAMPUS *Latr.* 59 sp. *Ichn. Cynipedis* Linn.

Abdomen ♂ not peduncled; antennæ more or less clavate, 13-jointed, third joint small, fourth as long as the fifth; ovipositor long, exserted; mesoscutellum convex; proscutellum short; legs subequal; stigmal branch very minute; max. palpi 4-, labial 3-jointed. Curtis, 552.

PERILAMPUS *Latr.* DIPLOLEPIS p. *Pz.* 6 sp. *P. italicus* Fab. Curtis, 158.

Head large; abdomen subpetiolated, short, contracted; ovipositor hidden; max. palpi 4-jointed; antennæ 13-jointed, second joint minute, third very minute, fourth large.

CRATOMUS *Dalm.* CARATOMUS *Boh.* 1 sp. *C. megacephalus* F. ♀. Steph. pl. 44. f. 4.

Head very large; mandibles 3- to 4-dentated; antennæ clavate, 13-jointed, second joint elongate, third small, fourth and following minute; club 3-jointed; stigmal branch long and curved.

ORMYRUS *Westw.* { CYRTOSOMA *Curt. ol.* / SIPHONURA *Nees.* / PERYCYPHUS *Bohem.* } 2 sp. *O. punctiger* Westw.

Antennæ short, thick, 13-jointed, third and fourth joints annular; thorax convex; abdomen ♀ cylindric-ovate, second to fifth joints punctured, and with rows of toothed impressions.

[2. Miscogasteridæ *Wlk.* Abdomen petiolated; stigmal branch straight.]

LAMPROTATUS *Westw.* { CHRYSOLAMPUS p. *Esenb.* / MISCOGASTER *Wlk.* } 57 sp. *L. splendens* Wes.

Body very shining; abdomen ♂ shorter than the thorax, convex-ovate, impressed at the base; antennæ long, filiform, 13-jointed, third and fourth joints annular; legs ♂ slender; collar transverse, quadrate; palpi simple; petiole short, thick.

PACHYLARTHRUS *Westw.* { PHACOSTOMUS *Nees.* / PHAGONIA *Curt.* } 3 sp. *Pt. patellanus* Dalm.

Head broad; maxillary palpi with the last joint very large, inflated; antennæ 13-jointed, third and fourth joints annular, the three last forming a small club; abdomen short, subtriangular, and depressed above in ♂; peduncle very short. Curtis, 427.

POLYCYSTUS *Westw.* ——— 2 sp. *P. Matthewsii* Westw.

Differs from Pachylarthrus in all the palpi having the terminal joint greatly inflated.

DICYCLUS *Wlk.* ——— 5 sp. *D. æneus* Wlk.

Antennæ ♀ clavate, 13-jointed, third and fourth joints annular, fifth joint moderate sized; abdomen ♀ depressed above, elongate-ovate, or subrotundate; petiole short; thorax long; mandibles 4-dentate.

CYRTOGASTER *Wlk.* CHRYSOLAMPUS p. *Esenb.* 9 sp. *C. rufipes* Wlk.

Abdomen convex; antennæ ♂ fusiform, 14-jointed; ♀ clavate, 13-jointed, third and fourth joints annular, fifth joint moderate sized; intermediate tibiæ not clavate; petiole short; thorax ovate; ovipositor scarcely exserted; last joint of max. palpi ♂ dilated.

PACHYNEURON *Wlk.* ——— 1 sp. *P. formosum* Wlk.

Space between the subcostal nerve and stigmal branch thickened; antennæ ♀ 13-jointed, fifth joint moderate sized; intermediate tibiæ not clavate; peduncle short; abdomen ♂ elongate-ovate, ♀ nearly rounded.

CORUNA *Wlk.* ——— 1 sp. *C. clavata* Wlk.

Abdomen ♂ ♀ clavate; intermediate tibiæ not clavate; peduncle short; thorax elongate; antennæ 13-jointed, ♂ filiform, ♀ thickened at the tips; third and fourth joints annular; mandibles 4-dentate.

TOXEUMA *Wlk.* ——— 2 sp. *T. fuscicornis* Wlk.

Abdomen ♀ elongate, compressed; intermediate tibiæ not clavate; peduncle short; thorax elongate; antennæ 13-jointed, third and fourth joints minute; ovipositor short, exserted.

MERISMUS *Wlk.* ——— 6 sp. *M. rufipes* Wlk.

Thorax elongate-ovate; prothorax rounded in front; peduncle elongate, narrowest behind; abdomen ♂ ovate, gibbous; ♀ elongate-ovate; antennæ subclavate.

PROSODES *Wlk.* ——— 1 sp. *Pr. ater* Wlk.

Prothorax rounded in front; thorax short, rounded; peduncle long; antennæ ♂ clavate, 13-jointed, third and fourth joints annular; abdomen short; legs slender, straight.

EUPSILOCERA *Westw.* PSILOCERA *Wlk.* [G. Tipulidæ.] 1 sp. *Ps. obscura* Wlk.

Prothorax rounded in front; thorax short; abdominal peduncle very short; antennæ ♂ moniliform, verticillate, longer than the body; abdomen ovate, depressed.

DIPARA *Wlk.* SPHEGIGASTER *Spin.*? 2 sp. *D. petiolata* Wlk.

Prothorax subquadrate; antennæ ♂ filiform, longer than the body, 12-jointed, third and following joints moniliform; petiole elongate; abdomen convex; subcostal nerve coalescing with the costa.

SYNTOMOPUS *Wlk.* ——— 2 sp. *S. thoracicus* Wlk.

Prothorax subquadrate; antennæ ♂, ♀ clavate; head large; thorax elongate; petiole linear; ovipositor subexserted; wings short.

MICROMELUS *Wlk.* ——— 2 sp. *M. rufomaculatus* Wlk.

Antennæ ♂ 13-jointed, thickened at the tip, third and fourth joints minute; petiole short; thorax long; abdomen ♂ broad, nearly rounded; ♀ ovate, convex above; wings sometimes almost obsolete.

ISOCYRTUS *Wlk.* ——— 1 sp. *I. lætus* Wlk.

Antennæ ♀ 12-jointed, subclavate, third and fourth joints minute; intermediate tibiæ not clavate; petiole short; thorax long; abdomen elongate-ovate, depressed; legs slender.

SPANIOPUS *Wlk.* ——— 1 sp. *S. dissimilis* Wlk.

Tibiæ straight; intermediate tibiæ clavate; petiole short; thorax long; prothorax rounded in front; antennæ 13-jointed, third and fourth joints annular; abdomen short, ovate.

[3. Ormoceridæ *Wlk.* Antennæ moniliform; abdomen sessile; stigmal branch straight.]

ORMOCERUS *Wlk.* ——— 4 sp. *O. vernalis* Wlk.

Antennæ short, clavate or subfiliform, 13-jointed, third and fourth joints minute; thorax convex above; abdomen not compressed; ovate, acuminate at tip; ovipositor not exserted.

MICRODELUS *Wlk.* ——— 8 sp. *M. rotundus* Wlk.

Antennæ 12-jointed, clavate; apex acuminate; thorax convex; abdomen not compressed, short, nearly rounded; ovipositor not exserted; stigma emitting a short nerve.

GLYPHE *Wlk.* ——— 1 sp. *G. autumnalis* Wlk.

Abdomen compressed, elongate-ovate, acuminate at tip; apex unarmed in ♀; thorax convex; antennæ 12-jointed, subclavate, with the last joint elongate-acuminate; stigma emitting a very short nerve.

GASTRANCISTRUS *Westw.* ——— 17 sp. *G. vagans* Westw.

Head broader than the thorax; antennæ 13-jointed in ♂, 12-jointed in ♀, third and fourth joints annular; fifth to ninth cup-shaped; abdomen elongate-ovate ♀; apex with two small recurved hooks; ovipositor exserted, more or less elongate; stigmal branch long and clavate; tarsi 5-jointed.

MEROMALUS *Wlk.* ——— 1 sp. *M. flavicornis* Wlk.

Antennæ submoniliform, 13-jointed ♂, not half the length of the body, with the last joint short; abdomen compressed, sublinear; thorax very convex.

RAPHITELUS *Wlk.* ——— 1 sp. *R. maculatus* Wlk.

Antennæ 12-jointed ♂, clavate, third and fourth joints minute, tenth and eleventh joints very short, last joint setiform; abdomen subcompressed, narrowed at the tip; thorax convex.

PSILONOTUS *Wlk.* ——— 1 sp. *Ps. adamas* Wlk.

Head flat in front, and rather produced; thorax flat; abdomen very compressed, longer than the thorax; antennæ 12-jointed; ♀ subclavate, submoniliform, clava ovate.

[4. Pteromalidæ *Wlk.* Abdomen flat, sessile; antennæ filiform, fusiform, or clavate; stigmal branch straight.]

SELADERMA *Wlk.* ——— 4 sp. *Sel. lætum* Wlk.

Antennæ 13-jointed, third and fourth joints minute; mesothoracic parapsides distinct; collar very minute, transverse; abdomen ovate or elongate-ovate, angulated beneath; ovipositor concealed.

SEMIOTELLUS *Westw.* SEMIOTUS *Wlk.* (G. Elateridæ.) 9 sp. *S. mundus* Wlk.

Antennæ 12-jointed; thorax coarsely punctured; mesothoracic parapsides distinct; collar very short, transverse; mandibles 3-toothed; abdomen ovate or elongate-ovate.

SYSTASIS *Wlk.* ——— 2 sp. *S. Encyrtoides* Wlk.

Antennæ 12-jointed, ♂ subfiliform, ♀ clavate; thorax not coarsely punctured, convex, short-ovate; collar very short, transverse; abdomen short-ovate, or rounder, flat above, ♀ angulated beneath.

EUNOTUS *Wlk.* ——— 1 sp. *E. cretaceus* Wlk.

Antennæ 11-jointed, third and fourth joints scarcely visible; metathoracic parapsides not distinct; prothorax very short, transverse; head very large; abdomen nearly quadrate ♂, basal joint covering the rest, ♀ apterous.

MERAPORUS *Wlk.* ——— 3 sp. *M. graminicola* Wlk.

Antennæ 12-jointed, clavate; club of moderate size, ovate, flat; thorax broad at the extremity; mesothoracic parapsides not distinct; abdomen ♂ very small, rounded, ♀ ovate.

METASTENUS *Wlk.* ——— 1 sp. *M. concinnus* Wlk.

Short; antennæ 12-jointed, subfusiform; club moderate sized, conic, acuminate; thorax narrowed at the extremity; mesothoracic parapsides indistinct; abdomen ovate, abruptly narrowed at base.

METOPON *Wlk.* ——— 1 sp. *M. atrum* Wlk.

Antennæ 12-jointed, clavate, fifth and following joints subequal; club very thick; collar minute, scarcely visible; abdomen small, compressed, flat; sides elevated.

PLATYTERMA *Wlk.* ——— 11 sp. *Pl. nobile* W.

Narrow, sublinear; antennæ 13-jointed, third joint scarcely visible, fourth and fifth minute; club short-ovate; thorax flat above, elongate-ovate; abdomen ♂ sublinear, ♀ ovate or sublinear.

AMBLYMERUS *Wlk.* ——— 27 sp. *A. amœnus* Wlk.

Short, broad; antennæ 13-jointed, clavate, shorter than the thorax, second joint elongate, cup-shaped, fifth and following, to the tenth, gradually shorter and broader; thorax convex above; collar very short.

PROSOPON *Wlk.* ——— 1 sp. *Pr. montanum* Wlk.

Head moderate sized, transverse; antennæ slender, clavate, 13-jointed, third and fourth joints minute; club ovate; thorax ovate; collar very short; abdomen ovate, flat; middle tarsi broad.

PLATYMESOPUS *Westw.* ——— 1 sp. *Pl. tibialis* Westw.

Maxillary palpi not furcate, second joint large, dilated, fourth very long; middle tibiæ broad, flattened, and internally sinuated, terminating on the outside in a fascicle; anterior tibiæ slightly dilated; abdomen ovate, depressed, much smaller than the thorax.

MESOPOLOBUS *Westw.* ——— 1 sp. *M. fasciiventris* Westw.

Head broad; antennæ gradually thickened, 13-jointed, third joint annular, fourth larger; mandibles 3 to 4-dentate; max. palpi ♂ furcate; middle tibiæ with a small hirsute lobe on the outside near the tip ♂.

ENTELUS *Wlk.* ——— 30 sp. *Ent. dilectus* Wlk.

Intermediate tibiæ simple; antennæ clavate, third and fourth joints minute; max. palpi slender, filiform; abdomen acuminate; intermediate femora often with a tooth beneath.

PTEROMALUS *Swederus.* ——— 254 sp. (Wlk.) *Ichn. puparum* Linn.

Femora slender, intermediate beneath setigerous near the tip; body pilose; ovipositor concealed or scarcely exserted; antennæ 13-jointed, with the third and fourth joints annular, fifth moderate sized; collar very short.

Obs. The species of this genus are arranged by Walker into about 140 sections, the majority of which are unnamed. Some, however, appear equivalent with the groups indicated in Curtis's *Guide*, under the MSS. names of Spintherus *Wlk.*, Eusela *Wlk.*, Lamprotes *Wlk.*, and Pterocelis *Hal.* The species still, however, require a careful subgeneric revision, in order to place them on a footing with the Miscogasteridæ and Ormoceridæ of Walker.

EPICOPTERUS *Westw.* ——— 1 sp. *E. choreiformis* Westw.

Very short, convex, contracted; antennæ short, subclavate, 12-jointed, third and fourth joints annular; fore wings with the humeral portion anteriorly dilated, and obliquely truncate at the place of union of the subcostal nerve with the costa; abdomen sessile.

METOPACHIA *Westw.* { GNATHO *Curtis.* / COLAX *Curtis.* } 1 ? sp. *C. dispar* Curtis. 166.

Head ♂ much broader than the thorax; thorax ovate; collar short; abdomen ♂ elongate-spatulate; ♀ elongate-conic, flat above, angulated beneath; ovipositor not exserted; antennæ 13-jointed, slender, filiform, third and fourth joints annular, very minute.

HETROXYS *Westw.* GASTRACANTHUS *Westw. ol.* 3 sp. *G. pulcherrimus* Westw.

Head broad, short; abdomen three times as long as the thorax, narrow, acuminated to the tip; collar triangular; antennæ slender, 13-jointed, third and fourth joints annular; legs simple.

CHEIROPACHUS *Westw.* CLEONYMUS *Curtis.* 2 sp. *D. quadrum* Fab.

Head transverse; antennæ 13-jointed, third and fourth joints annular, three terminal joints coalite; collar short, transverse; anterior and posterior femora ♂ thick, anterior thickened and notched at the tip ♀. Curtis 194. and Zl. Jl. vol. iv. pl. 2. f. 2.

MEROSTENUS *Wlk.* ——— 1 sp. *M. Phedyma* Wlk.

Narrow, sublinear; head large, transverse; antennæ 13-jointed, third and fourth joints minute; thorax long, linear; collar large, subquadrate; abdomen sublinear, flat; apex subquadrate; legs long, simple.

TRIGONODERUS *Westw.* ——— 22 sp. *Tr. obscurus* Westw.

Thorax subovate; collar triangular; antennæ ♀ 13-jointed, second joint minute,

third half as long as first, fourth to eighth short, equal, five terminal joints forming a club a little larger than the eighth joint.

[5. Cleonymidæ *Wlk.* Stigmal branch incurved.]

CLEONYMUS *Latr.* DIPLOLEPIS *Fab.* 3 sp. *D. depressus* Fab.

Thorax elongate-ovate; collar nearly square; antennæ 11-jointed ♀ second joint longer than the fourth, which is not annular, tenth joint produced on the outside; abdomen elongate-ovate, sides nearly parallel, quite flat; peduncle very short; ovipositor concealed. Zl. Jl. vol. iv. pl. 2. f. 1.

MACRONEURA *Wlk.* ——— 1 sp. *M. maculipes* Wlk.

Sublinear; antennæ moniliform, 13-jointed, third joint minute, fourth to tenth subovate, equal; mandibles 3-dentate; thorax long-ovate; collar large; legs thick, simple; anterior tibiæ armed with a long curved spur; stigmal branch long, subarcuate; ovipositor not exserted.

Subfamily 4. *Encyrtides* Westw.

CALOSOTER *Wlk.* ——— 2 sp. *C. vernalis* Wlk. Curt. 596.

Narrow, sublinear; head moderate; antennæ filiform, 13-jointed, third joint small, fourth and following gradually shortening; thorax long-ovate; abdomen sublinear, flat; middle tibiæ with a long spur; tarsi dilated.

STENOCERA *Curtis.* ——— 1 sp. *St. Walkeri* Curt. Curt. 596.

Long, sublinear; head subquadrate; antennæ filiform, 11-jointed, inserted near the mouth, third joint minute, fourth and following gradually shortening; thorax fusiform; collar subquadrate, narrowed in front; abdomen fusiform; middle tibiæ longer, with a strong spur; middle tarsi dilated.

PLATYNOCHEILUS *Westw.* STENOCERA p. *Wlk.* 2 sp. *P. Erichsonii* Westw.

Elongate, slender; collar triangular; thorax elongate-ovate; abdomen oblong, depressed; antennæ 11-to 12?-jointed, third and following joints small, coalite, five following distinct, equal; costa very much incrassated at base as far as the stigma. Ent. Mag. vol. iv. p. 437.

EUPELMUS *Dalm.* ——— 4 sp. *E. mnemonius* Dalm. De Geer, 2. t. 31. f. 22.

Antennæ 13-jointed, clavate, third and fourth joints minute; club ovate; thorax long-ovate; collar moderate; thorax depressed in the middle; abdomen long-ovate; ovipositor exserted; wings with stigmal branch distant from the union of the subcostal nerve and the costa.

UROCRYPTUS *Westw.* EUPELMUS p. *Dalm.* 1 sp. *E. excavatus* Dalm.

Antennæ 13-jointed, thickened towards the tip, subapterous; collar and mesothorax greatly elevated and channelled; abdomen ovate, convex; ovipositor hidden.

CHEILONEURUS *Westw.* EUPELMUS p. *Dalm.* 1 sp. *Eu. elegans* Dalm.

Mandibles 3-dentate; antennæ 11-jointed; collar attenuated; scutellum fasciculated; stigmal branch very short, removed a little from the union of the subcostal nerve with the costa; legs as in Encyrtus.

ECTROMA *Westw.* EUPELMUS p. *Dalm.* 1 sp. *E. rufus* Dalm.

Head large; mandibles 3-toothed; antennæ 9-jointed, long in ♂, ninth joint not larger than the eighth; thorax oblong, quadrate; collar acuminate; ovipositor hidden.

ERICYDNUS *Hal.* ——— 2 sp. *Eric. paludatus* Hal.

Antennæ ♂ 13-jointed, ♀ 12-jointed, third and following joints gradually shortening; thorax ovate, flat; collar very minute; abdomen ovate, flat ♂, ovate ♀; ovipositor concealed; legs long; middle tibiæ with a strong spur; tarsi dilated.

ENCYRTUS *Dalm.* MIRA *Schell.* 108 sp. *E. scutellaris* Dalm. Curt. 395.
Antennæ 11-jointed, inserted near the mouth, none of the joints annular; thorax square behind; abdomen short, broad at base; tarsi 5-jointed; middle tibiæ dilated, with long spurs; tarsi dilated; stigmal branch very small, arising at the union of the subcostal nerve with the costa; ovipositor not exserted.

CHOREIUS *Westw.* (nec SPHENOLEPIS *Es.*) 2 sp. *Encyrtus ineptus* Dalm. (*nigro-ænea* Westw.) Mag. Nat. Hist. March 1833.
Apterous, broad, subdepressed; antennæ simple, formed as in the typical Encyrti, as are also the middle legs; thorax quite square; scutellum very large, subquadrate; first segment of abdomen very large and broad.

CERAPTEROCERUS *Westw.* ——— 1 sp. *C. mirabilis* Westw.
Differs from Encyrtus in antennæ very large, flat, like those of Cerapterus; stigmal nerve placed at some distance from the apex of the subcostal nerve.

CERCHYSIUS *Westw.* ENCYRTUS p. *Dalm.* 2 sp. *Enc. Urocerus* Dalm.
Wings and middle legs as in Encyrtus; antennæ ♀ cylindrical, 10-jointed, with the second to seventh joints nearly equal; ovipositor thick and exserted, nearly as long as the abdomen.

TETRACNEMUS *Westw.* ——— 1 sp. *T. diversicornis* Westw.
Thorax and middle legs as in Encyrtus; antennæ 8-jointed, third, fourth, and fifth joints very minute, and emitting, as well as the sixth, a long branch; last joint thick, ovate; tarsi 5-jointed; subcostal nerve running for a short distance along the costa and emitting a short branch. Mag. Nat. Hist. vol. i. n. s. p. 257.

AGONIONEURUS *Westw.* { APHELINUS *Dalm.* ? *Wlk.* / MYINA *Nees.* } (13 sp. Wlk.) *Ag. basalis* Westw.
Short, broad, obtuse; subcostal nerve short, running but a short distance after its union with the costa, and terminating in a callous point; antennæ short, clavate, 6-jointed; second joint half as long as first; third, fourth, and fifth short, gradually increasing; sixth very large, oval; tarsi 5-jointed; spur of middle legs large.

PTEROPTRIX *Westw.* ——— (10 sp. Wlk.) *Pt. dimidiatus* Westw.
Very short and broad; eyes large, pilose; antennæ 8-jointed, second and third joints equal; fifth, sixth, and seventh much longer; eighth very minute; scutellum large; wings with long ciliæ; stigmal branch short, forming an acute angle; tarsi 4-jointed.

COCCOPHAGUS *Westw.* APHELINUS p. *Wlk.* 3 sp. *Ented. scutellaris* Dalm.
Antennæ 8-jointed, second joint smaller than the third, which is of equal size with the fourth and fifth, three terminal joints forming a club; tarsi 5-jointed; stigmal branch short, curved at the tip.

TRICHOGRAMMA *Westw.* CALLEPTILES *Hal.* 1 sp. *T. evanescens* Westw.
Head as broad as the thorax; antennæ 6-jointed, second joint short, slender, third larger than the second; fourth and fifth short; sixth very large; thorax longer than abdomen; scutellum large; wings with the pile arranged in twelve lines; tarsi 3-jointed.

Subfamily 5. *Eulophides* Westw.

STENOMESIUS *Westw.* ——— 2 sp. *St. pulchellus* Westw.
Antennæ long, slender, 9-jointed; second joint half as long as third; collar attenuated; abdomen with a short peduncle, small, spatulate in ♂, larger, ovate in ♀; intermediate tibiæ very slender, clavate at tips in ♂.

EUPLECTRUS *Westw.* ELACHESTUS p. *Esenb.* 1 sp. *Eupl. maculiventris* W.
Head small; antennæ slender, 9-jointed, second joint short; third to sixth ovate;

abdomen with a short peduncle, spatulate; posterior coxæ very large; hind tibiæ with a very long spine in both sexes.

HEMIPTARSENUS *Westw.* ——— 3 sp. *H. fulvicollis* Westw.

Antennæ long, simple in both sexes, 7-jointed, second joint small; third to sixth equal, oblong; seventh smaller, ovate (inarticulate?); abdomen ovate, depressed, acuminate at tip; wings ♂ abbreviated.

DICLADOCERUS *Westw.* ——— 1 sp. *D. Westwoodii* Steph.

Differs from Eulophus in antennæ ♂ biramose; sc. 9-jointed, second joint small; third and fourth longer, each emitting a branch; fifth and sixth thicker, simple; the three last forming a mass. My vol. i. frontisp. f. 4.

ELASMUS *Westw.* ANEURE *Esenb.* 1 sp. *Eul. flabellatus* Fonsc.

Antennæ ♂ with the third to fifth joints extremely short, each emitting a long branch, sixth long; ♀ 10-jointed, third and fourth joints annular; sides of the metathorax in both sexes produced behind into a large concave plate.

EULOPHUS *Geoff.* ——— 37 sp. *Wlk. Eul. pectinicornis* Linn.

Antennæ ♂ 9-jointed, third, fourth, and fifth joints emitting a long branch at base; ♀ 3-jointed, simple; tarsi 4-jointed; stigmal branch long; abdomen depressed; max. and labial palpi 3-jointed. Curt. 133.

Obs. Mr. Walker also introduces into this genus my Dicladoceri, Euplectri, Hemiptarseni, and Stenomesii, together with 49 other species, forming nearly as many sections.

ENTEDON *Dalm.* { ELACHESTUS *Esenb.* / EULOPHUS p. *Esenb.* } 19 sp. *Eul. Latreillei* Curt.

Subcostal nerve of the fore wing longer than a third of the wing; stigmal branch very short; antennæ simple, short.

Obs. Dalman's types of this genus are the species whose males have 3-ramose antennæ, which being the typical Eulophi, Dalman's name ought only to be considered as a synonym. Mr. Walker however retains it, placing in it my Closteroceri, Derosteni, Smaragdites, Omphale *Hal.*, and 124 other species, forming nearly as many sections.

SMARAGDITES *Westw.* ELACHESTUS p. *Esenb.* 1 sp. *Sm. admirabilis* Westw.

Antennæ as long as the entire body, apparently 9-jointed; basal joint dilated, second short, third very small; the remainder long, filiform, with long hairs; thorax ovate; abdomen longer and much narrower than the thorax, elongate-ovate.

DEROSTENUS *Westw.* ——— 1 sp. *D. gemmeus* Westw.

Head large; antennæ 9-jointed; fourth, fifth, and sixth joints broadest, hairy; three terminal joints forming a small attenuated mass; collar very narrow; abdomen smaller than the thorax, depressed; peduncle long.

CLOSTEROCERUS *Westw.* ——— 2 sp. *Cl. trifasciatus* Westw.

Antennæ 8-jointed; basal joint dilated at the tip, the remainder forming a depressed fusiform club; fourth joint rather larger than the third and fifth; abdomen nearly sessile, ovate, depressed; wings large.

APROSTOCETUS *Westw.* ——— 11 sp. *A. caudatus* Westw.

Antennæ 8-jointed, second, third, fourth, and fifth joints equal, but gradually thickened; abdomen elongate, sessile, twice as long as the thorax; ovipositor exserted; tarsi 4-jointed.

OMPHALE *Hal.* ——— 7 sp. *O. Salicis* Hal.

Antennæ 7-jointed, ♂ elongate, linear, verticillate-pilose, terminal joints equal;

♀ filiform, terminal joints decreasing in length; scutellum slightly convex, without longitudinal lines; cubital nervure short, nearer the tip of the wing.

CIRROSPILUS *Westw.* ——— 138 sp. [Wlk.] *Cirr. elegantissimus* Westw.
Head emarginate between the eyes; antennæ ♀ short, thick, 7-jointed, second joint half as long as the third; fourth shorter than the third, the three terminal ones forming a mass; abdomen ovate-conic, depressed; petiole short; subcostal nerve of the fore wing twice as long as a third of the wing. Steph. pl. 46. f. 3.

Family 5. *PROCTOTRUPIDÆ* Steph. (Oxyuri *Latr.*)
Subfamily 1. *Diapriides* Westw. (*Diapriadæ* Hal.)

DIAPRIA *Latr.* (1796.) PSILUS *Jur.* 17 sp. *Ps. elegans* Jur. Steph. pl. 46. f. 2.
Antennæ ♂ 14-jointed, verticillate; ♀ 12-jointed; head scarcely elongated; mandibles forcipate; cells obliterated; a small callous spot in the place of the stigma.

PLATYMISCHUS *Westw.* ——— 1 sp. *Pl. dilatatus* W. vol. i. Frontisp. fig. 5.
Apterous, depressed, narrow; antennæ 14-jointed; third joint large, internally produced; thorax oblong-quadrate.

CEPHALONOMIA *Westw.* ——— 1 sp. *C. formiciformis* Westw.
Head ♂ moderate, ♀ large, oblong, flat; antennæ 12-jointed ♂ ♀; ♂ filiform ♀; short, submoniliform; collar triangular; wings with a short subcostal nerve terminated by a callous spot. Mag. Nat. Hist. Sept. 1833.

ANEURHYNCHUS *Westw.* MYTHRAS *Hal.* 6 sp. *An. galesiformis* Westw.
Head transverse, with a small frontal tubercle; antennæ ♂ scarcely as long as the body, 14-jointed, second joint minute; third slender, and rather longer; fourth thicker; stigma indistinct; subcostal basal nerve not reaching the costa, but obliquely extended for a short distance into the disc of the wing, whence it is directed towards the tip of the wing, forming a long marginal cell.

GALESUS *Curtis.* PSILUS p. *Panz.* 4 sp. *Psil. cornutus* Pz. Curtis, 341.
Antennæ ♂ 14-, ♀ 12-jointed, thickened at tip; front of head much produced; mandibles rostriform; nerves indistinct.

PARAMESIUS *Westw.* CERAPSILON *Hal.* 4 sp. *P. rufipes* Westw.
Head sub-quadrate, with a frontal tubercle; antennæ ♂ longer than the body, filiform, 13-jointed; second and third joints minute; peduncle one third of the length of the abdomen; nerves as in Cinetus gracilipes (Curtis 380. 9.), but the marginal cell is longer and truncated at base; lab. palpi 2-jointed.

BASALYS *Westw.* ——— 1 sp. *B. fumipennis* Westw.
Head not rostrated; antennæ ♂ 14-jointed; second and third joints small; fourth large, produced externally; remainder slender; two subcostal nerves scarcely reaching the third part of the wing, the transverse nerve connecting them at the tip, forming a triangle with a nerve running obliquely from the middle of the posterior of them.

SPILOMICRUS *Westw.* PSILUS p. *Spin.* 6 sp. *Sp. stigmaticalis* Westw.
Head transverse-quadrate; antennæ ♀ rather longer than the thorax, 13-jointed, thickened to the tip; stigma small before the middle of the costa, its apex internally deflexed, emitting a short branch directed towards the base of the wing; basal cell subtriangular; the other nerves indistinct; peduncle of moderate length, striated; lab. palpi 2-jointed.

BELYTA *Jurine.* ——— 8 sp. *B. bicolor* Jur. pl. 14. f. 8.
Antennæ ♀ short, 15-jointed, not thickened at tips, with the joints perfoliated; ♂ 14-jointed, filiform; marginal cell contracted, not completely closed.

CINETUS *Jurine.* ——— 15 sp. *C. gracilipes* Curt.
Antennæ ♂ 14-jointed, long, slender; ♀ 15-jointed, thickened at tip; marginal cell small, trigonate; labial palpi 3-jointed; disc of wings not areolated.

ISMARUS *Hal.* CINETUS p. *Curt.* 5 sp. *Cin. dorsiger* Curtis. Curt. 380.
"Antennæ seated near the mouth, filiform, 14 joints ♂, 15 ♀; mesothoracic scutum lævigate; wings with one brachial, and a small triangular radial areolet." Haliday MSS.

HELORUS *Latr.* PSEN p. *Panz.* 2 sp. *H. ater* Jur. Curtis, 403.
Antennæ porrected, 13-jointed; max. palpi 5-, labial 3-jointed; wings strongly areolated; abdomen petiolated.

Subfam. 2. *Proctotrupides* Westw.

PROCTOTRUPES *Latr.* CODRUS *Jur.* 18 sp. *P. niger* Panz. My fig. 78. 1.
Mandibles without teeth; anterior tibiæ with a single spur; valves of ovipositor long, exserted; antennæ 12-jointed.*

Subfam. 3. *Gonatopides* Westw. (Aculeata Cenoptera, or fam. Dryinidæ, and Bethyllidæ, *Hal.*)

APHELOPUS *Dalm.* ♂ HETEROLEPIS *Esenb.* 3 sp. *Aph. atratus* Dalm.
Mouth broad; max. palpi long, pendulous, 6-jointed; anterior tarsi ♀ simple; discoidal cells indistinct. Ent. Mag. pl. 16. f. 3.

ANTEON *Latr.* DRYINUS *Latr.* 8 sp. *A. Jurineanum* Latr.
Mouth broad; max. palpi long, pendulous, 6-jointed; anterior tarsi ♀ chelate; inner claw connate with two joints of the tarsus; discoidal cells distinct.

CHELOGYNUS *Hal.* DRYINUS p. *Curtis.* 14 sp. *D. cursor* Hal. Curt. 206.
Differs from Anteon in inner claw of fore legs ♀ being connate with only one joint of the tarsus.

LABEO *Hal.* ANTEON? p. *Westw.* 2 sp. *L. excisus* Westw. Ent. Mag. pl. 16. f. 2.
Mouth small; max. palpi 3-jointed; thorax short, compact; stigma narrow; occiput deeply notched.

MYRMECOMORPHUS *Westw.* ——— 1 sp. *M. rufescens* Westw.
Head rounded-oblong; ocelli 0; antennæ as long as the body, 10-jointed; thorax twice as long as the head; collar subquadrate; wings scarcely rudimental; fore legs simple; max. palpi 3-, labial 2-jointed.

EMBOLEMUS *Westw.* ——— 1 sp. *Emb. Ruddii* Westw. Ent. Mag. pl. 16. f. 1.
Head with a frontal tubercle, on which the antennæ are placed; these are 10-jointed, longer than the body, filiform; second joint very minute; fore legs simple; one marginal, two indistinct submarginal, two basal, and two discoidal cells; legs long and slender.

GONATOPUS *Ljn. & Kl.* DICONDYLUS *Hal.* 5 sp. *G. pedestris* Dalm.
Thorax elongate, constricted in the middle, apterous; fore tarsi chelate; fore coxæ very long; max. palpi 5-jointed. My fig. 78. 15.

BETHYLUS *Latr.* OMALUS p. *Jur.* 5 sp. *B. cenopterus* Pz. Curt. 720.
Head oblong, flattened; antennæ 12-jointed, filiform, the terminal joints narrowed at the base; two long basal cells, the posterior shortest.

EPYRIS *Westw.* PRISTICERA *Kl.*? 3 sp. *Ep. niger* Westw. Ent. Mag. p. 16. f. 6.
Head moderate, subconvex; antennæ elongate, filiform, inserted near the mouth,

* Mr. Haliday has just had the kindness to forward to me his monograph upon this genus, forming the first fascicle of his *Hym. Britann. Oxyura*, April, 1839.

13-jointed, cylindric, the joints not narrowed at base; thorax elongate-ovate, marginal cell incomplete, two basal cells of equal length.

Subfamily 4. *Ceraphrontides* Westw. (*Ceraphronidæ* Hal.)

MEGASPILUS *Westw.* { CALLICERAS p. *Esenb.* / CERAPHRON p. *Curt.* } 28 sp. *Cer. dux* Curt.

Antennæ elbowed, 11-jointed ♂ ♀; apex in ♀ but slightly clavate; upper wings with a large semicircular stigma; ocelli three; max. palpi 5-jointed, long, pendulous. Curtis, 249.

MICROPS *Hal.* CERAPHRON p. *Curt.* 4 sp. *Ceraphr. Rubi* Curtis.

Apterous; ocelli 0; eyes small; max. palpi 4-jointed; antennæ 11-jointed.

CALLICERAS *Esenb.* CERAPHRON p. *Curt.* (3 sp.?) *C. Carpenteri* Curt.

Winged; stigma large; antennæ ♂ verticillate.

CERAPHRON *Jur.* ——— 20 sp. *Cer. sulcatus* Jur. pl. 14. f. 9.

Antennæ ♂ 11-jointed, 10-jointed in ♀; max. palpi 4-jointed; stigma obsolete; stigmal branch curved, abrupt.

Subfamily 5. *Platygasterides* Westw. (Scelionidæ *Hal.*)

BAEUS *Hal.* ——— 1 sp. *B. seminulum* Hal. Ent. Mag. pl. 13. f. 6.

Apterous; thorax short; scutellum not visible; club of antennæ thick, oval, 5-annulated.

HEMISIUS *Westw.* ——— 1 sp. *H. minutus* Westw.

Head nearly as large as the thorax; antennæ placed on a frontal tubercle, long, distinctly 11-jointed, third smaller than the second; club 4-jointed; wings scarcely longer than the thorax; stigmal branch elongate, clavate, oblique; second abdominal segment very large.

GRYON *Hal.* ——— 2 sp. *G. misellus* Walk. Ent. Mag. pl. 16. f. 5.

Thorax short; abdomen sessile, with equal-sized segments; stigmal branch short, arising at the middle of the costa; scutellum distinct; antennæ 12-jointed.

TELENOMUS *Hal.* TELEAS p. *Esenb.* 26 sp. *Teleas phalænarum* Esenb.

Abdomen sessile, second joint elongated; stigmal branch arising at the middle of the costa, long, oblique. Ent. Mag. pl. 13. f. 1—4.

THORON *Hal.* TELEAS p. *Curt.* 1 sp. *Th. metallicus* Hal.

Abdomen petiolated; stigmal branch arising at the middle of the costa, long; club of antennæ ♀ indistinctly annulated. Ent. Mag. pl. 13. f. 11.

XENOMERUS *Wlk.* ——— 1 sp. *X. Ergenna* Wlk. Ent. Mag. 13. f. 10.

Antennæ ♂ long, verticillate; stigmal branch arising near the extremity of the costa, rather short.

TELEAS *Latr.* { TELEAS and PROSACANTHA *Esenb.* } 39 sp. *T. clavicornis* Latr.

Antennæ 12-jointed, slightly pubescent ♂; club 6-jointed ♀; thorax rather short; collar linear-arched; legs saltatorial; abdomen more or less petiolated; stigmal branch very short. Curt. 333.

SCELIO *Latr.* ——— 1 sp. *Sc. rugosulus* Latr. Curt. 325.

Max. palpi short, 3-jointed; front of head rounded; thorax oblong; antennæ ♂ 10-jointed, ♀ 12-jointed; marginal cell elongate-trigonate.

SPARASION *Latr.* ——— 1 sp. *Sp. frontale* Latr. Curt. 317.

Max. palpi long, 5-jointed; labial 3-jointed; front of head margined; antennæ 12-jointed.

PLATYGASTER *Latr.* ———— 108 sp. *Pl. ruficornis* Latr.*

Antennæ 10-jointed, clavate in ♀ ; max. palpi short, 2-jointed, labial 1-jointed; wings without cells or veins; legs not saltatorial; abdomen ♀ not cornuted; tarsi 5-jointed. Ent. Mag. No. 13. pl. 12. f. 10.

EPIMECES *Westw.*† PLATYGASTER p. *Wlk.* (3 sp. ?) *E. ensifer* Westw.

Abdomen ♀ with the last four segments as long as the second, and narrowed into a tail; antennæ ♀ 10-jointed, filiform; wings without distinct veins. Ent. Mag. No. 13. pl. 12. f. 15.

INOSTEMMA *Hal.* PLATYGASTER p. *Latr.* 9 sp. *Psil. Boscii* Jur. Curt. 309.

Fore wings with the subcostal nerve abruptly capitate; club of antennæ clavate in ♀, 4-jointed; abdomen ♀ cornuted. (My fig. 78. 13.)

IPHITRACHELUS *Hal.* ———— 1 sp. *Iph. Lar* Hal.

Tarsi 4-jointed; antennæ ♂ verticillate-pilose; subcostal nerve short, clubbed. Ent. Mag. No. 13. pl. 12. f. 1.

Subfamily 6. *Mymarides* Westw. (Mymaridæ *Hal.*)

MYMAR *Hal.* GONATOCERUS *Esenb.* 4 sp. *M. pulchellus.* Curt. 411.

Antennæ ♂ 13-jointed, ♀ 9-jointed; club inarticulate; scapus in both sexes elongate, linear; tarsi 4-jointed; abdomen peduncled. (My fig. 78. 16. ♂.)

OOCTONUS *Hal.* ———— 5 sp. *M. insignis* Hal.

Antennæ ♂ 13-jointed, ♀ 11-jointed, with an inarticulate club; tarsi 5-jointed.

ANAPHES *Hal.* ———— 4 sp. *Ichn. punctum* Shaw.

Antennæ ♂ 12-jointed, ♀ 9-jointed; club inarticulate; tarsi tetramerous; abdomen subsessile, ovoid. Linn. Trans. vol. xiv. pl. 18. fig. 1.

POLYNEMA *Hal.* ———— 7 sp. *Ichn. ovulorum* Linn.

Antennæ ♂ 13-jointed, ♀ 9-jointed; club inarticulate; scapus in each sex dilated, sinuated, but slightly elongate; abdomen petiolated.

LITUS *Hal.* ———— 5 sp. *L. dimidiatus* Hal.

Antennæ ♀ 9-jointed; club inarticulate; tarsi 5-jointed.

EUSTOCHUS *Hal.* CALLITRICHE *Esenb.* 1 sp. *M. atripennis* Hal.

Antennæ ♀ 10-jointed; club biarticulate; tarsi tetramerous; abdomen petiolated.

ANAGRUS *Hal.* ———— 5 sp. *Ichn. atomus* Linn.

Antennæ ♂ 13-jointed, ♀ 9-jointed; club inarticulate; tarsi 4-jointed; abdomen sessile, conic-acuminate.

* Latreille describes Platygaster as having the third joint of the antennæ much longer than the following joints, citing P. ruficornis as the type. Having examined and made a drawing of Latreille's typical specimen, attached to the generic label in his own hand-writing, still contained in the collection of the Baron Dejean, I am able to confirm this description (as stated in the *Mag. Nat. Hist.* vol. vi. p. 421.). The species considered as such by Messrs. Haliday (*Ent. Mag.* vol. i. p. 270.) and Walker (*Ditto*, vol. iii. p. 240.), must therefore, from its sectional characters, be distinct. The last paragraph in the note of the latter (*Ibid.* p. 243. a.) must consequently be struck out.

† Deceived by the filiform antennæ of the females of some species of Platygaster, I regarded them as males; and considered as their females other species which have also the abdomen elongated posteriorly; and upon which I constructed the genus Epimeces. Mr. Walker, in his *Monograph*, has pointed out this error; considering these females as forming separate sections in the genus Platygaster. The name Epimeces may, however, be retained for the species with filiform antennæ in the females, which I had regarded as males.

ALAPTUS *Hal.* ——— 1 sp. *M. minimus* * Wlk.
"Tarsi pentamerous; antennnæ ♂ 10-jointed, filiform, 8-jointed ♀, last joint enlarged." Haliday MSS.

Tribe 2. *Tubulifera* St. Farg. Hal., consisting of the single

Family *CHRYSIDIDÆ* Leach.

HEDYCHRUM *Latr.* Omalus p. *Panz.* 12 sp. *Ch. aurata* Linn. Curt. 38.
Abdomen semicircular, or nearly hemispheric, convolvent; scutellum not produced; thorax broadly truncate in front.

ELAMPUS *Spinola.* Hedychrum p. *Panz.* 1 sp. *Ch. Panzeri* Fab. Pz. 51. 11.
Abdomen convex, emarginate at the tip; scutellum terminating in a flat mucro; thorax broadly truncate in front.

CHRYSIS *Linn.* Sphex p. *Scop.* 23 sp. *Ch. ignita* Linn. Curt. 8.
Abdomen oblong, semi-cylindrical, concavo-convex, convolvent; scutellum not produced; thorax broad in front.

? EUCHREUS *Latr.* Chrysis p. *Panz.* 1 sp. *Ch. 6-dentata* Latr.? Pz. 51. 12.?
Abdomen subquadrate; scutellum not produced; thorax broadly truncate in front.

CLEPTES *Latr.* Sphex p. *Linn.* 2 sp. *Sph. semiaurata* Linn. Curt. 724.
Collar narrow; abdomen lanceolate-ovate, not convolvent, entire at the tip.

Sect. 2. Aculeata *Latr., Hal.* (*Hym. ovitithers* St. Farg. *H. monotrocha* Hart. H. normalia *Westw.*)

Subsect. 1. *Insectivora* Westw. (Fossores *Latr.* Lestica *Hal.*)

Family 1. *CRABRONIDÆ* Leach, Hal.

Subfamily 1. *Nyssonides* Westw. (Larridæ p. *Leach.*)

NYSSON *Latr.* Oxybelus p. *Fabr.* 4 sp. *N. interruptus* Fabr. Panz. 72. 13.
Mandibles toothless; eyes ♂ not united; antennæ inserted below the centre of the face; three submarginal cells, the second peduncled, and receiving two recurrent nerves.

ASTATA *Latr.* Dimorpha *Jur.* 1 sp. *Tiphia abdominalis* Pz. Curt. 261.
Thorax and abdomen ovate; second joint of lab. palpi securiform; eyes ♂ united behind; three submarginal sessile cells, the second receiving two recurrent nerves.

OXYBELUS *Latr.* Sphex p. *Schäff.* 6 sp. *Vespa uniglumis* Linn. Curt. 480.
Short; one submarginal cell, receiving one recurrent nervure; the discoidal nerve rudimental; antennæ short; mandibles toothless; metathorax armed.

TRYPOXYLON *Latr.* Apius *Jur.* 3 sp. *Sphex figulus* Linn. Curt. 652.
Eyes emarginate; one marginal, and one distinct submarginal cell; abdomen very long, narrow, peduncled; mandibles toothless.

PSEN *Latr.* Trypoxylon p. *Fabr.* 2 sp. *Sphex atra* Fabr. Panz. 72. 7.
Clypeus quadrate; abdomen long; first segment peduncled; antennæ central, thickened at the tip; three submarginal sessile cells, the second and third receiving a recurrent nerve; mandibles bidentate.

MIMESA *Shk.* Psen p. *Curtis.* 2 sp. *Psen equestris* Fabr. Curt. 25.
Three submarginal cells, the second receiving both recurrent nerves, third cell larger than the second.

* "The type of this genus is the smallest Hymenopterous insect known, being about half the size of Anagrus atomus." *Haliday MSS.*

Subfamily 2. *Crabronides* Westw. (Crabronidæ *Leach.*)

ALYSON *Jur.* Pompilus p. *Fabr.* 1 sp. *Al. spinosus* Jur. Curtis, 584.
Abdomen elongate-ovate; collar narrowed; three submarginal cells, the second peduncled, first and second receiving a recurrent nerve; metathorax spined and striated.

GORYTES *Latr.* Arpactus p. *Jur.* 2 sp. *Vespa mystacea* Linn. Curtis, 524.
Abdomen elongate-ovate; mandibles bidentate; four submarginal cells, the second narrowed at the base, sessile, and receiving two recurrent nerves; anterior tarsi simple in both sexes.

[HOPLISUS *St. Farg.* Gorytes p. *Shk.* 1 sp. *H. 5-cinctus* St. Farg.
Antennæ obtuse in both sexes; anterior tarsi ♀ ciliated. Pz. 72. 14.]

[EUSPONGUS *St. Farg.* Gorytes p. *Shk.* 2 sp. *E. laticinctus* St. Farg.
Anterior tarsi ♀ ciliated; antennæ ♀ thickened, acute at tip.]

[LESTIPHORUS *St. Farg.* Gorytes p. *Shk.* 1 sp. *Crab. bicinctus* Rossi.
Abdominal pedunclé pear-shaped; antennæ ♀ filiform, ♂ pointed at tip, tenth joint concave in ♂. Curtis, 524.]

ARPACTUS *Jur.* Pompilus p. *Panz.* 2 sp. *Ar. tumidus* Pz. Pz. 81. 15.
Three submarginal cells, second not peduncled, receiving two recurrent nerves; antennæ ♀ as long as ♂.

CRABRO *Fabr.* Sphex p. *Linn.* 42 sp. *Sphex cribraria* Linn. Curtis, 680.
Antennæ strongly elbowed; face very broad; one marginal cell slightly appendiculated, and one submarginal not confluent with the second discoidal; one recurrent nerve; mandibles slender, bifid at tip; max. palpi 6-, labial 4-jointed.

Obs. This genus has been greatly cut up by St. Fargeau. The following are such of his genera as have been found in this country, together with examples of each.

[THYREOPUS *St. Farg.* Crabro p. *Shk.* *Sphex cribraria* Linn. Pz. 15. 18, 19.]

[CROSSOCERUS *St. Farg.* Crabro p. *Shk.* *Cr. scutatus* Fabr. Pz. 15. 22.]

[THYREUS *St. Farg.* Crabro p. *Shk.* *Cr. vexillatus* Pz. Pz. 46. 5.]

[CERATOCOLUS *St. Farg.* Crabro p. *Shk.*? *C. Lindenius*? Shk.]

[SOLENIUS *St. Farg.* Crabro p. *Shk.* *Sphex vaga* Linn. Pz. 46. 10.]

[BLEPHARIPUS *St. Farg.* Crabro p. *Shk.* *Cr. dimidiatus* Fabr. Pz. 43. 15.]

[LINDENIUS *St. Farg.* Crabro p. *Shk.* *Crabro albilabris* Fabr. Pz. 15. 24.]

[PHYSOSCELIS *St. Farg.* Crabro p. *Shk.* *Crabro rufiventris.* Pz. 72. 12.]

RHOPALUM *Kirby.* Corynopus *St. Farg.* 3 sp. *Crabro tibialis* Fabr.
Abdomen with a long knotted peduncle; marginal cell with a long terminal branch; submarginal and discoidal cell as in Crabro; max. palpi 5-, labial 3-jointed. Curtis, 656.

STIGMUS *Jurine.* ——— *St. ater* Jur. Jurine, pl. 9. 7.
Antennæ not elbowed; two submarginal cells, first receiving the only recurrent nerve, which joins the cubital about the middle of the first submarginal cell; second small; two discoidal cells; stigma very large; mandibles elongate, tridentate.

SPILOMENA *Shk.* Celia *Shk. olim.* 1 sp. *Stig. troglodytes* V. L.
Stigma very large; two submarginal cells, one recurrent nerve anastomosing with the first transverso-cubital.

PEMPHREDON *Fabr.*, *Westw.* DIODONTUS *Curtis.* 3 sp. *P. minutus* Fabr.
Clypeus transverse, tridentate; mandibles bidentate, strong; two submarginal cells, each receiving a recurrent nerve, second truncate-triangular; labrum bidentate. Curtis, 496.

PASSALŒCUS *Shk.* { XYLŒCUS *Shk.* in tab. / DIODONTUS p. *Curt.* } 3 sp. *P. insignis* Shk.
Two submarginal cells, each receiving a recurrent nerve, second cell transverse, not petiolated; mandibles bidentate or tridentate.

CEMOMUS *Jur.*, *Westw.* PEMPHREDON *Latr.*, *Curt.*, *Shk.* 2 sp. { *lugubris* Fabr. / *unicolor* Jur.
Mandibles short, strong, 3-dentate; abdominal peduncle moderate; upper wings with two submarginal cells, the second square, the first and second receiving a recurrent nerve; labrum entire. Jur. pl. 11. f. 28.

DIPHLEBUS *Westw.* { CEMOMUS p. *Jur.*, *Shk.* / PEMPHREDON *Latr.* / DINEURUS *Westw. olim.* } 2 sp. *Pelop. unicolor* Fabr. Nec Jurine.
Mandibles elongate, 4-dentate; two submarginal cells, the first receiving two recurrent nerves; three discoidal cells; abdominal peduncle short.

CERATOPHORUS *Shk.* PEMPHREDON p. *V. L.* 1 sp. *P. Morio* V. L.
Petiole of abdomen short; second submarginal cell widest towards the marginal mandibles ♀ bidentate.

MELLINUS *Fabr.* SPHEX p. *D. G.* 2 sp. *Vespa arvensis* Linn. Curt. 580.
Abdomen elongate, narrowed at the base, first segment knotted at the tip; tarsal pulvillus large; three complete submarginal sessile cells, fourth commenced, the first and third receiving a recurrent nerve.

PHILANTHUS *Fabr.* SEMBLEPHILUS *Jur.* 1 sp. *Ph. androgeus* Rossi.
Abdomen elongate-ovate; three submarginal cells, second sessile; marginal cell nearly linear, acuminate. Curtis. 273.

CERCERIS *Latr.* PHILANTHUS p. *Fab.* 13 sp. *Sph. arenaria* Linn. Curtis, 269.
Abdominal segments constricted; three submarginal cells, second peduncled, second and third receiving a recurrent nerve.

Family 2. *LARRIDÆ* Leach.

LARRA *Fab.* LIRIS p. *Fabr. olim.* 1 sp. *L. Ichneumoniformis* F. Pz. 76. 18.
Hirsute; antennæ filiform; marginal cell appendiculated; third submarginal cell narrow, oblique; mandibles without teeth; abdomen elongate; metathorax long. My fig. 82. 14.

LYROPS *Ill.* TACHYTES *Pz.* 3 sp.? *Larra pompiliformis* Pz. Pz. 89. 13.
Mandibles with one short tooth; abdomen short, ovate; metathorax shorter than the dorsolum.

MISCOPHUS *Jur.* ——— 1 sp. *M. bicolor* Jur. Steph. pl. 42. f. 3.
Two submarginal cells, second petiolated; marginal cell not appendiculated; antennæ filiform; mandibles with one short tooth; abdomen ovate.

DINETUS *Jur.* POMPILUS p. *Fabr.* 1 sp. *D. pictus* Jur. Steph. pl. 42. f. 4.
Two submarginal sessile cells; antennæ ♂ moniliform at base; mandibles with several teeth; marginal cell appendiculated.

Family 3. *BEMBECIDÆ* Leach.

There is no British species of this family.

Family 4. *SPHEGIDÆ* Westw.

Subfamily 1. *Pompilides* Westw. (Pompilidæ *Leach.*)

APORUS *Spin.* ——— 1 sp. *Ap. unicolor* Sp. Steph. pl. 41. f. 1.
Two complete submarginal cells, the second receiving two recurrent nerves; thorax long; legs moderate; collar quadrate.

? CRYPTOCHEILUS *Pz.* POMPILUS p. *Fab.* 1 sp. *Ps. annulatus* F.
Antennæ inserted in the middle of the face; three complete submarginal cells; max. palpi much longer than labial; labrum concealed. Panz. 76. 16.

POMPILUS *Latr., Schiodte.* PSAMMOCHARES *Latr. olim.* 24 sp. *Sph. gibba* Linn.
Thorax oblong; antennæ inserted nearer the mouth; three complete submarginal cells; marginal cell almost semicircular; aculeus not exserted. Curtis, 238.

[AGENIA *Schiodte.* POMPILUS p. *Auct.* *Sph. variegatus* Linn. Pz. 87. 21.]
Anterior tarsi simple; posterior tibiæ finely pilose, not spined; labrum emarginate; mandibles bidentate; labium trifid.

[PRIOCNEMIS *Schiodte.* POMPILUS p. *Auct.* *Sph. exaltatus* Fabr. Pz. 86. 10.]
Anterior tarsi with short spines; posterior tibiæ serrulate and spined ♀; mandibles bidentate.

[EPISYRON *Schiodte.* POMPILUS p. *Auct.* *Sph. rufipes* Linn. Pz. 65. 17.]
Anterior tarsi ♀ pectinated; posterior tibiæ spined; labrum longitudinally cleft; mandibles long, tridentate ♀.

CEROPALES *Latr.* POMPILUS p. *Panz.* 1 sp. *Cer. maculatus* F. Pz. 72. 9.
Labrum advanced; max. palpi long; abdomen short; hind legs very long; four submarginal cells; aculeus exserted. Curtis 754., and my fig. 83. 14.

Subfamily 2. *Sphegides* Westw. (Sphecidæ *Leach.*)

DOLICHURUS *Latr.* PISON *Latr., Gen.*, nec *Spin., Jur.* 1 sp. *D. ater* Latr.
Mandibles toothed; max. palpi longer than the labial; anterior tarsi ♀ not spinose; abdominal peduncle very short; four submarginal cells. Steph. pl. 42. f. 1.

? PELOPÆUS *Latr.* SCELIPHRON *Klug.* 1 sp. ? *Sph. spirifex* Linn., Jur.
Max. palpi longer than the labial; antennæ central; tarsal pulvillus large; labial lobes equal; abdominal peduncle long. Donov. pl. 531.

SPHEX *Linn.* PEPSIS p. *Fabr.* 1 sp. *Sph. flavipennis* Jur. Steph. pl. 41. f. 3.
Maxillæ and labium short, reflexed near the tip; antennæ central; abdominal peduncle short; marginal cell nearly linear; three submarginal cells, second submarginal cell receiving the first recurrent nerve.

AMMOPHILA *Kirby.* PEPSIS p. *Linn.* 5 sp. *Sph. sabulosa* Linn. My fig. 83. 1.
Abdominal peduncle long; maxillæ and labium long, reflexed in the middle; three submarginal cells, the second receiving two recurrent nerves; third sessile smaller than the second.

MISCUS *Jur.* AMMOPHILA p. *Latr.* 1 sp. *Am. campestris* Latr. Curtis, 604.
Abdominal petiole 2-jointed; third submarginal cell triangular and peduncled.

Family 5. *SCOLIIDÆ* Westw. (Scoliadæ *Leach.*)

Subfamily 1. *Scoliides* Westw.

TIPHIA *Latr.* BETHYLUS *Pz.* 4 sp. *T. femorata* Pz. Curtis, 664.
Marginal cell incomplete in ♀; two submarginal cells, each receiving a recurrent nerve; mandibles not toothed. My fig. 84. 1.

Subfamily 2. *Sapygides* Westw. (Sapygidæ *Leach.*)

SAPYGA *Latr.* Hellus p. *Fabr.* 2 sp. *S. punctata* Klug. Curtis, 532.
Antennæ more or less thickened at tip; eyes emarginate; mandibles broad, multidentate; abdomen cylindrical; four submarginal cells, second and third receiving a recurrent nerve.

Family 6. *MUTILLIDÆ* Leach.

MUTILLA *Linn.* Sphex *De G.* 3 sp. *M. Europæa* Linn. Curtis, 77.
Antennæ inserted in the middle of the face; three submarginal cells ♂; thorax ♀ continuous and apterous. My fig. 84. 13. 14.

MYRMOSA *Latr.* Hylæus *Fabr.* 1 sp. *M. melanocephala* Fabr.
Four submarginal cells ♂; thorax ♀ not constricted in the middle. Latr. Gen. pl. 13. 6.

TENGYRA *Latr.* ♂
METHOCA *Latr.* ♀ Mutilla p. *Jur.* } 1 sp. { *T. Sanvitali* Latr. Ent. Text. B. pl. 3. f. 5.
M. Ichneumonides Latr. Curtis, 329., and my fig. 84. 19.
Three submarginal cells ♂; thorax ♀ trinodose; max. palpi elongate.

Division 2. *Sodales* Westw. (Philopona *K.* Heterogyna p. *Latr.*)

Containing the single

Family *FORMICIDÆ* Leach.

MYRMICA *Latr.* Manica *Jur.* 6 sp. *Form. rubra* Linn. Donovan, 503.
Abdomen armed with a sting; basal joint of antennæ long; abdominal peduncle 2-jointed; max. palpi 6-jointed; mandibles triangular.

MYRMECINA *Curtis.* ——— 1 sp. *M. Latreillei* Curt. Curt. 265.
Basal joint of antennæ very short ♂; mandibles wanting?; abdominal peduncle 2-jointed; max. palpi 4-jointed, labial 3-jointed ♂; one marginal cell often appendiculated; one submarginal cell.

STENAMMA *Westw.* N. G. 92. *Steph. Cat.* 1 sp. N. G. *Westwoodii* Steph.
Basal joint of antennæ long; abdominal peduncle 2-jointed, first joint long, knotted; max. palpi 4-jointed, labial 3-jointed; mandibles broad, oblique, 5-dentate. My fig. 86. 11.

PONERA *Latr.* Formica p. *Latr. olim.* 1 sp. *F. contracta* Latr.
Abdomen armed with a sting; abdominal peduncle formed of one large scale; mandibles triangular; eyes of neuters obsolete. Steph. pl. 42. f. 2.

FORMICA *Linn.* Lasius p. *Fabr.* 12 sp. *F. fusca* Linn. My fig. 85.
Sting wanting; basal joint of antennæ very long; abdominal peduncle consisting of a single elevated scale; max. palpi 6-jointed, labial 4-jointed in ♂ ♀ ☿; eyes distinct. Curtis, 752.

Division* 3. *Diplopteryga* Kirby. (Diploptera *Latr.*)

Family 1. *EUMENIDÆ* Westw., Hal. (Vespidæ p. *Leach.*)

EUMENES *Latr.* Vespa p. *Linn.* 1 sp. *Eum. atricornis* Fab. Curtis, 13.
Abdomen with the basal segment narrowed and pear-shaped; maxillæ and labium elongated. My fig. 87. 6.

ODYNERUS *Latr.* Symmorphus† *Wesmael.* 3 sp. *V. muraria* Linn. Pz. 53. 9.

* The *divisions* Insectivora (p. 79.), Sodales and Diplopteryga, compose the first *subsection* Prædones (described in my Vol. ii. p. 184.), but omitted in p. 79.

† As Latreille gives the Linnæan V. muraria as the type of the genus Odynerus

Abdomen ovoid, conic; basal segment short, subcampanulate; maxillæ and labium of moderate length; antennæ ♂ simple.

OPLOMERUS *Westw.* { EPIPONE *Kirby*, nec *Latr.* / OPLOPUS* *Wesm.* / ODYNERUS *Shk.* } 3 sp. *V. spinipes* Linn.

Dorsal surface of the first segment of abdomen consisting of only one piece; posterior surface of metathorax entire, and convex at the sides; antennæ ♂ spiral at tips. Pz. 17, 18.

ANCISTROCERUS *Wesmael.* ODYNERUS *Curt.* 20 sp. *V. parietinus* Linn.

Dorsal surface of first segment of abdomen formed of two pieces; sides of metathorax angulated; last joint of antennæ ♂ hooked. Curt. 137. My fig. 87. 1.

Family 2. *VESPIDÆ* Westw. (Vespidæ p. *Leach.*)

VESPA *Linn. &c.* ——— 6 sp. *V. vulgaris* Linn. My fig. 88.

Abdomen ovoid; mandibles broad, oblique at the tip, and toothed; clypeus quadrate, truncate in front. Curtis, 760.

Subsect. 2. *Mellifera* Latr. (or Anthophila *Latr.*)

Family 1. *ANDRENIDÆ* Leach. Proabeille *Réaum.* Melitta *K.*)

Subfamily 1. *Obtusilingues* Westw.

HYLÆUS *Latr.* nec *Fabr.* PROSOPIS *Jur.* 7 sp. *Apis annulata* Linn. Curtis, 373.

Body smooth, naked; two complete submarginal cells; no pollinigerous organs.

COLLETES *Latr.* EVODIA *Panz.* 3 sp. *Apis succincta* Linn. Curtis, 85.

Hirsute, pollinigerous; three complete submarginal cells, second and third receiving a recurrent nerve.

Subfamily 2. *Acutilingues* Westw.

SPHECODES *Latr.* DICHROA *Illiger.* 4 sp. *Sphex gibba* Linn. My fig. 90. 14.

Antennæ ♂ nodose; four submarginal cells; maxillæ strongly elbowed; no pollinigerous organs; labium straight. K. M. A. A., pl. 2. and 15.

HALICTUS *Latr.* MEGILLA p. *Fabr.* 29 sp. *Hylæus 6-cinctus* Fab.

Pollinigerous; central division of labium longer than the external; abdomen ♀ with a terminal slit; four submarginal cells. K. M. A. A., pl. 2. and 15.

[LASIOGLOSSUM *Curtis.* ——— 1 sp. *L. tricingulum* Curt. Curt. 448.]

Characters of Halictus, but with the terminal lobes of the maxillæ more elongated and lanceolate.

ANDRENA *Fabr.* MELITTA** *C. Kirby.* 80 sp. *Apis cineraria* Linn. Curt. 129.

Pollinigerous; three complete submarginal cells; mentum long and narrow; labium shorter than the palpi; its central division grooved; antennæ ♂ simple.

CILISSA *Leach.* ANDRENA p. *Latr.* 3 sp. *Andr. hæmorrhoidalis* Pz. Panz. 65. 20.

Antennæ ♂ subserrate; maxillæ bent in the middle; labium longer than the palpi.

(see Vol. II. p. 240. note,), I have retained it as such. It is congenerous with Odyn. crassicornis *Pz.*, belonging to Wesmael's genus Symmorphus, which name must be rejected, being used by Klug for a genus of bees.

* This generic name is employed by Laporte, for a genus of Lamellicorn beetles.

DASYPODA *Latr.* Trachusa p. *Jur.* 1 sp. *Melitta Swammerdamella* K.
Basal joint of posterior tarsi very long, and densely pilose ♀ ; central labial lacinia lanceolate and reflexed ; two submarginal cells ; ocelli in a line. Curt. 367.

Family 2. *APIDÆ* Leach. (Abeille *Réaum.*, Apis *K.*)

Subfamily 1. *Andrenoides* Latr. (Panurgides *Westw.*)

PANURGUS *Panz.* Eriops *Klug.* 2 sp. *Apis ursina* Gmel. Curtis, pl. 101.
Antennæ clavate or subclavate ; mandibles acute ; two complete submarginal cells.

SYSTROPHA *Illiger.* Hylæus p. *Fabr.* 1 sp. *Hyl. spiralis* Fab.
Antennæ ♂ spiral ; max. palpi thrice as long as the maxillary lobe ; labial palpi with the second joint twice as long as the preceding ; three complete submarginal cells. Panz. F. I. G. 35. 22.

Subfamily 2. *Denudatæ* Latr. (Melectides *Westw.*)

NOMADA *Scopoli.* Apis *Linn.* 40 sp. *Apis ruficornis* Linn. Curt. 419.
Elongate, glabrous ; marginal cell broad ; labial palpi continuous, maxillary 6-jointed.

MELECTA *Latreille.* Symmorpha *Kl.* 1 sp. *Apis punctata* Fab. Curt. 125.
Short, hirsute ; three marginal cells very narrow ; paraglossæ half as long as the labium ; max. palpi short, 5-jointed.

EPEOLUS *Latreille.* Nomada p. *Fab.* 1 sp. *Apis variegata* Linn. Curtis, 1. 516.
Short, glabrous ; max. palpi minute, 1-jointed ; last joints of labial palpi oblique.

Subfamily 3. *Longilabres* Westw. (or Megachilides *Westw.*)

CÆLIOXYS *Latr.* Trachusa p. *Jur.* 3 sp. *Apis conica* Linn.
Abdomen acute ♀, dentate at tip in ♂ ; pollinigerous organs wanting ; mandibles broad, toothed ; max. palpi minute, 3-jointed. Curtis, B. E, pl. 349.

STELIS *Panz.* Gyrodroma *Klug.* 2 sp. *Stelis aterrima* Pz.
Short, ovate ; abdomen not pollinigerous ; labrum oblong, quadrate ; mandibles triangular-dentate, max. palpi 2-jointed. Kirby, M. A. A. 2. pl. 16. f. 9.

ANTHIDIUM *Fab.* Trachusa p. *Jur.* 1 sp. *Apis manicata* Linn. My fig. 91. 1.
Abdomen broad, subconvex, dentate ♂, rounded and pollinigerous ♀ ; max. palpi minute, exarticulate ; mandibles strong, dentate ; claws bifid. Curtis, pl. 61.

OSMIA *Panz.* { Hoplitis *Kl.* / Amblis *Kl.* } 10 sp. *Apis bicornis* Linn. Curtis, pl. 222.
Max. palpi short, 4-jointed ; mandibles broad, irregularly toothed ; abdomen convex above, pollinigerous ; antennæ ♂ long ; tongue very pilose.

MEGACHILE *Latr.* Phyllotoma *Dumeril.* 10 sp. *Apis centuncularis* Linn.
Max. palpi short, 2-jointed ; abdomen ovate or triangular, flat above ; mandibles broad, 4-dentate ; labrum quadrate. Curt. 218.

HERIADES *Spinola.* Anthidium p. *Panz.* 2 sp. *Apis truncorum* Linn.
Elongate ; mandibles triangular, bidentate ; max. palpi 2-jointed ; second joint of labial palpi very long, fourth obsolete ; abdomen pollinigerous beneath ; dentate in ♂. Curt. 504.

CHELOSTOMA *Latr.* Anthidium p. *Panz.* 1 sp. *Apis florisomnis* Linn.
Elongate, subcylindric ; mandibles triangular, bidentate ; max. palpi minute, 3-jointed ; two complete submarginal cells ; labial palpi 4-jointed. Curt. 628.

CERATINA *Latr.* { Pithitis *Kl.* / Clavicera *Walck.* } 1 sp. *Apis cærulea* Vill.

Oblong; antennæ subclavate; mandibles tridentate; abdomen not woolly beneath; labrum short; max. palpi 6-, labial 2-jointed. My fig. 91. 13.

Subfamily 4. *Scopulipedes* Latr. (Anthophorides *Westw.*)

EUCERA *Scopoli.* ANDRENA p. *Panz.* 4 sp. *Apis longicornis* Linn.
Paraglossæ setiform, as long as the labial palpi, which are 4-jointed; antennæ ♂ nearly as long as the body; max. palpi 6-jointed; two complete submarginal cells. Kirby, M. A. A. 2. pl. 17. f. 3, 4.

ANTHOPHORA *Latr.* { PODALIRIUS *Latr. olim.* / LASIUS *Jur.* } 2 sp. *Apis retusa* Linn.
Three complete submarginal cells of equal size; labial palpi with the third joint affixed obliquely; max. palpi 6-jointed; intermediate legs ♂ with long brushes of hair. Curt. 357.

SAROPODA *Latr.* HELIOPHILA *Klug.* 5 sp. *Apis rotundata* Panz. Curt. 361.
Paraglossæ much shorter than the labial palpi; max. palpi 4-jointed; labial palpi straight; three complete submarginal cells.

?XYLOCOPA *Latr.* CENTRIS p. *Fabr.* 1 sp.? *Apis violacea* Fab.
Broad, bombiform, hirsute; mandibles ♀ obtuse; labrum short, densely ciliated; three complete submarginal cells; second triangular. Kirby, M. A. A. 2. pl. 17. f. 9.

MELITTURGA *Latr.* EUCERA p. *Latr. olim.* 1 sp. - *M. clavicornis* Latr.
Abdomen elongate-ovate; max. palpi 6-jointed; antennæ ♂ short, clavate; labial palpi straight. Latr. Gen. t. 14. f. 14.

Subfamily 5. *Sociales* Latr. (Apides *Westw.*)

BOMBUS *Latr.* BREMUS *Jur.* 37 sp. *Apis muscorum* Linn.
Hind tibiæ spurred; pollinigerous; two last joints of labial palpi minute, oblique. Kirby, M. A. A. 2. pl. 18.

APATHUS *Newm.* { PSYTHIRUS *St. F.* / PSEUDO-BOMBUS *St. MSS.* } 5 sp. *Apis rupestris* Fabr.
Hind tibiæ spurred; pollinigerous organs wanting. Curtis, 468.

APIS *Linn. &c.* ——— 1 sp. *Apis mellifica* Linn. My fig. 92., and Curtis 769.
Hind tibiæ not spurred; basal joint of hind tarsi of neuters striated.

ORDER VIII. STREPSIPTERA *Kirby.* (RHIPIPTERA *Latreille.*) Composing the single

Family *STYLOPIDÆ* Kirby.

STYLOPS *Kirby.* ——— 5 sp. *St. Melittæ* K. My Vol. I. front. f. 6.
Eyes peduncled; antennæ 6-jointed, flattened, third producing a very large flat lobe. Curtis, 226.

ELENCHUS *Curtis.* STYLOPS p. *Kirby.* 1 sp. *St. tenuicornis* K. Curtis, 385.
Eyes sessile; antennæ 5-jointed, long, slender; third joint produced into a long slender appendage.

HALICTOPHAGUS *Dale.* ——— 1 sp. *H. Curtisii* Dale. Curtis, 433.
Eyes peduncled; antennæ 7-jointed; third and three following joints producing a flattened branch.

Order IX. LEPIDOPTERA *Linn.* (Glossata *Fabr.*)

Sect. I. Rhopalocera *Dumeril, Bdv.* (*Diurna* Latr. *Papilio* Linn. *Papilionidæ* Horsf.)

Subsect. 1. *Nudi* Westwood.

Family 1. *PAPILIONIDÆ* Leach. (Hexapoda *Latr.* Chilognathiform Stirps *Horsf.*)

Subfamily 1. *Papilionides* Westw. (*Equites and Heliconii* Linn.)

PAPILIO *Linn.* Amaryssus *Hubn.* 2 sp. *Pap. Machaon* L. Curtis, 576.
Hind wings tailed; labial palpi very short; larva with a nuchal fork.

DORITIS *Fab.* Parnassius *Latr.* 1 sp. *P. Apollo* L. Donov. pl. 433.
Hind wings rounded; labial palpi moderate; larva with a nuchal fork; chrysalis folliculated.

Subfamily 2. *Pierides* Westw. (*Danai* Linn.)

PIERIS *Latr.* Leuconea *Donzel.* 1 sp. *P. Cratægi* L. Curtis, 360.
Wings rounded, almost denuded of scales; club of antennæ compressed; second and third joints of labial palpi equal.

GONIAPTERYX *Westw.* { Rhodocera *Bdv.* / Gonepteryx *Leach* } 1 sp. *P. Rhamni* L. Curtis, 173.
Wings angulated; antennæ short, clavate, tufted at base.

COLIAS *Fab.* Pieris p. *Schr.* 4 sp.? *P. Hyale* L. Curtis, 242.
Hind wings rounded; antennæ short; club gradual; last joint of labial palpi minute; ungues deeply bifid.

PONTIA *Fabr.* Pieris p. *Boisduv.* 7 sp.? *P. Brassicæ* L. Donov. pl. 446.
Hind wings rounded; fore wings trigonate, squamose; club of antennæ compressed; last joint of labial palpi longer than second.

MANCIPIUM *Hubn., Steph.* Anthocharis *Bdv.* 2 sp. *Pap. cardamines.*
Wings varied beneath; fore wings rounded at tip; last joint of labial palpi shorter than the second. My fig. 96. 1.

LEUCOPHASIA *Steph.* Pieris p. *Latr.* 1 sp. *P. sinapis* L.
Wings suborbicular; discoidal cell small, basal; labial palpi short, flat; first joint very large; last very small. Donov. pl. 280. f. 2.

Family 2. *HELICONIIDÆ* Swainson. (There is no British species belonging to this family.)

Family 3. *NYMPHALIDÆ* Swainson. (Nymphalis *Linn.*)

Subfamily 1. *Nymphalides* Westw. (*Chilopodiform Stirps* Horsfield.)

VANESSA *Fab.* Hamadryades *Hub.* 7 sp. *Pap. Io* Linn. Curtis, 96.
Antennæ abruptly clubbed; eyes very pubescent; fore wings angular.

CYNTHIA *Fabr.* Vanessa p. *Curtis.* 2 sp. *P. cardui* Linn. Donov. pl. 292.
Antennæ abruptly clubbed, compressed; eyes very pubescent; wings scalloped, anterior subfalcate.

APATURA *Fabr.* Nymphalis *Latr.* 1 sp. *Pap. Iris* L. Curtis, 338.
Antennæ gradually clubbed; club nearly straight; eyes naked; labial palpi slender; hind wings scalloped.

LIMENITIS *Fabr.* Nymphalis *Latr.* 1 sp. *Pap. Camilla* L. Curtis, 124.
Antennæ gradually clubbed; eyes pubescent; fore wings rounded at the end.

ARGYNNIS *Fabr.* Dryades *Hub.* 4 sp. *Pap. Paphia* L. Curtis, 290.
Antennæ with a short abrupt club; eyes naked; wings broad; head large.

MELITÆA *Fabr.* Lemoniades *Hub.* 6 sp. *Pap. Cinxia* L. Curtis, 386.
Antennæ with a short abrupt compressed club; eyes naked; fore wings elongate, triangular; head moderate.

Subfamily 2. *Hipparchiides* Westw. (*Satyrides* Boisduval. *Thysanuriform Stirps* Horsfield.)

HIPPARCHIA *Fabr.* Satyrus *Latr.* 16 sp. *Pap. Megæra* L. Curtis, 205.
Antennæ with an elongate, compressed, and curved club; head small; wings more or less rounded.

Family 4. *ERYCINIDÆ.*

HAMEARIS *Hub.* Nemeobius *Steph.* 1 sp. *Pap. Lucina* L. Curtis, 316.
Eyes pubescent; palpi short; fore legs spurious in ♂, perfect in ♀.

Family 5. *LYCÆNIDÆ* Leach. (Polyommatidæ *Swainson.* Vermiform Stirps *Horsf.*)

THECLA *Fabr.* Lycæna p. *Ochs.* 5 sp. *Pap. Betulæ* L. Curtis, 264.
Club of antennæ elongate; eyes pubescent; hind wings generally tailed.

LYCÆNA *Fabr.* Polyommatus *Latr.* 5 sp. *Pap. Phlæas* L. Curtis, 12.
Club of antennæ ovate; eyes naked; hind wings not tailed.

POLYOMMATUS *Latr.* Argus p. *Scop.* 13 sp. *P. Arion* L. Lewin, pl. 37.
Club of antennæ abrupt, compressed; eyes pubescent or naked; wings entire; posterior obsoletely denticulated.

Obs. P. argiolus and Alsus belong to Dr. Horsfield's subgenus Pithecops.

Subsection 2. *Involuti* Boisduval. Containing the single
Family 1. (or 6.) *HESPERIIDÆ* Swainson. (Anopluriform Stirps p. *Horsf.*)

THYMELE *Fabr.* Thanaos *Bdv.* 2 sp. *P. Tages* L. Lewin, pl. 45. f. 3, 4.
Club of antennæ curved and fusiform, not hooked; fore wings rounded posteriorly.

PAMPHILA *Fabr.* Steropes *Bdv.* 7 sp. *P. Comma* L. Curtis, 442.
Club of antennæ abrupt, fusiform, and hooked at the tip; fore wings nearly triangular.

Sect. II. Heterocera *Boisduval.*
Family 1. *SPHINGIDÆ* Leach. (Sphingidæ and Sesiidæ *Steph.*)

SMERINTHUS *Latr.* Laothoe *Fabr.* 3 sp. *Sph. ocellata* L. Curtis, 482.
Wings angulated; spiral tongue short.

ACHERONTIA *Ochs.* Brachyglossa *Bdv.* 1 sp. *Sph. Atropos* L.
Wings entire, acute; spiral tongue short. Curtis, 147.

SPHINX *Linn.* Eumorphæ *Hub.* 6 sp. *Sph. Ligustri* L. Curtis, 195.
Wings entire, acute; spiral tongue very long; antennæ not clavate; labial palpi robust.

DEILEPHILA *Ochs.* Spectrum p. *Scop.* 3 sp. *Sph. Euphorbiæ* L. Curt. 3.
Wings entire, not subfalcate; spiral tongue long; labial palpi robust; antennæ clavate; neck of larva not retractile.

DAPHNIS *Hubn.* SPHINX *Linn.* 1 sp. *Sph. Nerii* L. Curtis, 626.
Wings entire, acute, posterior slightly lobed; spiral tongue long; antennæ and labial palpi slender; caterpillar with the neck retractile.

METOPSILUS *Duncan.* EUMORPHÆ *Hub.* 3 sp. *Sph. Elpenor* L.
Fore wings subfalcate; antennæ obscurely clavate; spiral tongue long; neck of caterpillar retractile. Donov., pl. 122.

MACROGLOSSA *Ochs.* SESIA p. *Fabr.* 1 sp. *Sph. Stellatarum* L. Curt. 747.
Wings squamose; apex of abdomen strongly tufted.

SESIA *Fabr.* MACROGLOSSA p. *Ochs.* 2 sp. *Sph. fusiformis* L. Curtis, 40.
Wings partially hyaline; abdomen tufted at the extremity.

Family 2. *URANIIDÆ* Westw.
(There is no British species of this family.)

Family 3. *ANTHROCERIDÆ* Westw. (Zygænidæ *Steph.*)

INO *Leach.* PROCRIS *Fabr.* 1 sp. *Sph. Statices* L. Curtis, 396.
Antennæ straight, ♂ bipectinated, ♀ simple; posterior tibiæ not spurred.

ANTHROCERA *Scop.* ZYGÆNA *Fab.* 5 sp. *Sph. filipendulæ* L. Curt. 547.
Antennæ with an abrupt, bent, fusiform club; posterior tibiæ spurred.

Family 4. *ÆGERIIDÆ* Steph. (Sesiades *Latr.*)

ÆGERIA *Fabr.* TROCHILIUM *Steph., Curt.* 2 sp. *Sph. apiformis* L. Curt. 372.
Maxillæ very short; abdomen robust; antennæ abbreviated.

TROCHILIUM *Scop.* { SESIA p. *Latr.* / ÆGERIA *Steph., Curt.* } 11 sp. *Sph. tipuliformis* L.
Maxillæ elongated; abdomen slender; strongly tufted; antennæ long, slender. Curtis, 53.

Obs. Mr. Newman has separated this genus as follows: — Pyropteron *N.*, type S. chrysidiformis; Bembecia *Hubn.*, type Sph. Ichneumoniformis; Synanthedon *Hubn.*, type Sph. Œstriformis; Trochilium, type Sph. tipuliformis *Linn.*; Conopia *Hubn.*, type Sph. culiciformis; Paranthrene *Hubn.*, type Sph. vespiformis *Linn.* (Asiliformis *Haw.*)

Family 5. *HEPIALIDÆ* Steph. (Hepialites *Latr.*, R. An.)

HEPIALUS *Fab.* HEPIOLUS *Ill.* 5 sp. *Ph. Humuli* L. Curt. 185.
Labial palpi obsolete; antennæ subfiliform, much shorter than the thorax.

COSSUS *Fabr.* HEPIALUS p. *Schr.* 1 sp. *C. ligniperda* Fab. Curt. 60.
Labial palpi erect; antennæ setaceous, as long as the thorax, denticulated to the tip ♂ ♀.

ZEUZERA *Latr.* COSSUS p. *Fabr.* 1 sp. *Ph. Æsculi* L. Curt. 722.
Labial palpi very small; antennæ ♂ bipectinated from the base to the middle, ♀ simple.

Family 6. *BOMBYCIDÆ* Steph. (Bombycites *Latr.*, R. An.)

SATURNIA *Schr.* ATTACUS *Germar.* 1 sp. *Ph. Pavonia minor* L. Don. pl. 1. 254.
Wings entire, ocellated; joints of antennæ with two internal and two external pectinations.

ERIOGASTER *Germ.* GASTROPACHA E. *Ochs.* 1 sp. *Ph. lanestris* L. Don. 310.
Wings entire; fore wings subdiaphanous, elongated, with a central white spot; larvæ gregarious; eggs covered with down.

PŒCILOCAMPA *Steph.* LASIOCAMPA p. *Lea.* 1 sp. *Ph. populi* L. Donov. 307.
Wings entire; fore wings subdiaphanous, elongate, without a central spot; apex of abdomen of females not tufted; larva solitary; eggs naked.
Obs. Cnethocampa (*St.*) processionea and C. Pityocampa are doubtful natives.

CLISIOCAMPA *Curt.* GASTROPACHA E. *γ. Ochs.* 3 sp. *Ph. Neustria* L.
Wings entire, short; hind wings subtruncate, subacute; antennæ short; larvæ gregarious; eggs arranged in a spiral coil. Curt. 229.

TRICHIURA *Steph.* LASIOCAMPA p. *Schr.* 1 sp. *Ph. Cratægi* L. Donov. 117.
Wings entire, rounded, obtuse, opake; antennæ straight; tail strongly tufted in both sexes.

LASIOCAMPA *Schr.* GASTROPACHA C. D. *Ochs.* 4 sp. *Ph. Quercus* L. Curt. 181.
Wings entire, opake; joints of ♂ antennæ strongly bipectinated; tail scarcely hirsute.

ODONESTIS *Germ.* GASTROPACHA B. *Ochs.* 1 sp. *Ph. Potatoria* L. Donov. 148.
Fore wings entire, acute at the apex, posterior slightly denticulated; labial palpi elongated.

DENDROLIMUS *Germar.* EUTRICHA *Steph.* 1 sp. *Ph. Pini* L. Curtis, 7.
Hind wings denticulated; labial palpi rather short; antennæ short, nearly straight; larva with a tubercle on the eleventh segment.

GASTROPACHA *Ochs.* LASIOCAMPA p. *Schr.* 1 sp. *Ph. Quercifolia* L. Curt. 24.
All the wings dentate; labial palpi elongate; antennæ curved.

Family 7. *ARCTIIDÆ.* (Pseudo-Bombyces *Latr.*)

Subfamily 1. *Notodontides* Westw.

STAUROPUS *Germ.* HARPYIA *Ochs.* 1 sp. *Ph. Fagi* L. Curt. 674.
Fore wings narrow, with raised tufts on the disc; antennæ ♂ bipectinated, except at the tip; larvæ with the second and third feet long, and with two slender anal appendages.

PYGÆRA *Ochs.* LARIA p. *Schr.* 1 sp. *Ph. bucephala* L. Curt. 530.
Apex of wings subdenticulated; posterior margin of fore wings not lobed; thorax crested; antennæ ♀ setose; larvæ cylindrical, pilose.

CLOSTERA *Hoff.* PYGÆRA A. *Ochs.* 5 sp. *Ph. curtula* L. Curt. 705.
Wings entire; thorax crested; antennæ bipectinated ♂ ♀; larva with a tubercle on the third and eleventh segments.

NOTODONTA *Ochs.* PTILODONTIS p. *Hub.* 4 sp. *Ph. dromedarius* L. Curt. 739.
Fore wings slightly denticulated at the tip, inner margin with a tuft; thorax not crested; antennæ ♂ bipectinated; larva with conical dorsal tubercles.

LEIOCAMPA *Steph.* NOTODONTA C. *Ochs.* 2 sp. *Ph. dictæa* L. Donov. 239. f. 1.
Fore wings slender, rather acute, inner edge with a tuft; antennæ ♀ slightly pectinated; thorax not crested; larva naked, with a small tubercle on the anal segment.

LOPHOPTERYX *Steph.* NOTODONTA B. *Ochs.* 3 sp. *Ph. Camelina* L.
Thorax crested behind; fore wings strongly denticulated, inner margin with a tuft; larva slightly hairy, with an anal tubercle. Donov. pl. 183.

PTEROSTOMA *Germ.* ORTHORHINIA *Bdv.* 1 sp. *Ph. palpina* L. My fig. 106. 4.
Labial palpi greatly elongated; thorax crested; inner margin of fore wings with two tufts; larva naked, smooth.

PETASIA *Steph.* ASTEROSCOPUS *Bdv.* 1 sp. *Bo. cassinea* F. Donov. 397. f. 2.
Labial palpi short; fore wings entire, with a tuft of scales on the inner edge; larva naked, fleshy, with the anal segment gibbose.

PERIDEA *Steph.* NOTODONTA D. *Ochs.* 1 sp. *Bo. serrata* Thunb. Donov. 359.
Wings subdiaphanous and elongate, fore wings with a single tuft on inner edge; antennæ serrated; larva sphingiform.

DRYMONIA *Hubn.* CHAONIA *St.* 3 sp. *Noct. Roboris* F. Curt. 755.
Antennæ ♂ bipectinated, ♀ subserrate; fore wings entire, with a little tuft of scales; thorax very slightly crested.

PTILOPHORA *Steph.* NOTODONTA D. *Ochs.* 1 sp. *Bomb. plumigera* W. V.
Wings subdiaphanous, pubescent; abdomen tufted in ♂; antennæ ♂ with very long pectinations; larva smooth, naked. Curtis, 328.

CERURA *Schr.* DICRANURA *Latr.* 9 sp. *Ph. vinula* L. Curtis, 193.
Thorax not crested; wings subhyaline, upper pair long; max. palpi distinct; larva with two anal filaments.

EPISEMA *Ochs.* GRAPHIPHORA p. *Hub.* 1 sp. *Ph. cæruleocephala* L. Donov. 100.
Wings entire; thorax crested; maxillæ short, filamentous; antennæ sub-elongate, straight; larvæ cylindrical, not tuberculed.

ENDROMIS *Ochs.* DORVILLIA *Leach.* 1 sp. *Ph. versicolor* L. Curtis, 434.
Antennæ bipectinated in both sexes; body thickly clothed with hairs; wings very ample and transparent; larva sphingiform, with an anal tubercle.

Subfamily 2. *Arctiides* Westw. (*Arctiidæ* Steph.)

LIMACODES *Latr.* APODA *Haw.* 1 sp. *Hep. Testudo* F. Donov. pl. 76.
Wings opake, elongate, posteriorly rounded; antennæ simple; maxillæ obsolete; palpi short.

HETEROGENEA *Kir.* HEPIALUS *Fab.* 1 sp. *H. asellus* W.V. Steph. pl. 17. f. 2.
Antennæ ♂ simple; wings triangular, posteriorly subtruncate, opake; maxillæ obsolete; palpi very minute.

FUMEA *Haw.* PSYCHE p. *Curt.* 5 sp. *B. pulla* Esp. Curt. 332.
Trophi obsolete; wings subdiaphanous, rounded, very pilose, ♀ apterous; antennæ ♂ strongly pectinated, about 20-jointed.

PSYCHE *Schr.* NUDARIA p. *Haw.* 1 sp. *N. fusca* Haw. St. pl. 18. f. 3, 4.
Trophi obsolete; wings subdiaphanous, not squamose, elongate, subacute, ♀ apterous.

[THYRIDOPTERYX *Steph.* SPHINX *Haw.* 1 sp. *Sph. Ephemeræformis* H. Steph. in Ent. Trans. i. pl. 10. f. 1.]

NUDARIA *Haw.* PH. ATTACUS *L.* 3 sp. *Ph. mundana* L. Curt. 400.
Maxillæ much longer than the head; wings diaphanous, pilose, short; antennæ simple in both sexes.

Obs. The six preceding genera are not at all typical of this subfamily, but I have placed them in this situation in order to maintain the passage from the slender-bodied tiger moths to the Lithosiidæ unbroken. Whereas in Stephens's arrangement they interrupt this chain, whilst in Curtis's *Guide* they are thrown out of the family after the Lithosiidæ.

HYPOGYMNA *Hubn.* LARIA p. *Schr.* 1 sp. *Ph. dispar* L. Donov. 163.
Maxillæ obsolete; wings opake; antennæ pectinated in both sexes; first joint of labial palpi minute; abdomen ♀ with a brush.

PSILURA *Steph.* HYPOGYMNA *Curt.* 1 sp. *Ph. monacha* L. Curt. 767.
Maxillæ obsolete; wings opake; antennæ pectinated in both sexes; basal joint of labial palpi elongate-clavate; abdomen ♀ pointed.

ORGYIA *Ochs.* Laria p. *Schr.* 2 sp. *Ph. antiqua* L. Curt. 378.
Maxillæ obsolete; wings opake, short, triangular ♂, almost obsolete ♀; antennæ ♂ strongly bipectinated, ♀ serrated; labial palpi biarticulate, clavate.

DASYCHIRA *Steph.* Laria *Schr.* 2 sp. *Ph. fascelina* L. Donov. 576.
Maxillæ obsolete; anterior tarsi very pilose; wings elongate, opake; legs short, stout, pilose; palpi very short.

DEMAS *Steph.* Colocasia *Ochs.* 1 sp. *Ph. Coryli* L. Donov. 309.
Maxillæ short, subspiral; wings opake; thorax crested; antennæ slightly pectinated.

LEUCOMA *Steph.* Arctia *Curt.* 2 sp. *Ph. Salicis* L. Donov. 30.
Maxillæ short; wings subdiaphanous; body unspotted; palpi short, rather divergent; abdomen ♀ not tufted.

LÆLIA *Steph.* Arctia p. *Curt.* 1 sp. *Bo. cænosa* Hb. Curt. 68.
Maxillæ short; wings subdiaphanous; body unspotted; palpi elongate, projecting; antennæ moderate, shorter in ♀.

PORTHESIA *Steph.* Laria p. *Schr.* 2 sp. *Ph. chrysorrhœa* L. Donov. 10.
Maxillæ distinct; wings opake; thorax not crested; body not spotted; tail ♂ thickly tufted, ♀ with a downy mass; antennæ short.

TRICHETRA *Westw.* { Trichocercus *Ste.* (g. Infusor. *Lam.* / Arcturus *Curt.* (g. Crustac. *Lat.* } 1 sp. *A. Sparshalii.*
Trophi minute; antennæ strongly pectinated; fore wings sublanceolate, densely squamose; abdomen with a large tuft of hairs. Curt. 336.

SPILOSOMA *Steph.* Arctia p. *Schr.* 5 sp. *Ph. lubricipeda* L. Curt. 92.
Maxillæ short; wings opake; body spotted; basal joint of palpi longer than second, third short, ovate.

CYCNIA *Hub.* Diaphora *Steph.* 1 sp. *Ph. mendica* L. Donov. 388.
Maxillæ short; wings subdiaphanous, sub-abbreviated; body spotted; palpi distinct, squamose, with last joint as long as second.

PHRAGMATOBIA *Steph.* Arctia p. *Schr.* 1 sp. *Ph. fuliginosa* L. Don. 80.
Maxillæ short; wings subdiaphanous; body spotted; palpi scarcely distinct, pilose; antennæ short, nearly simple in both sexes.

PENTHOPHORA *Germar.* Liparis p. *Ochs.* 1 sp. *P. nigricans.* Curt. 213.
Maxillæ obsolete; wings subdiaphanous, clothed with minute scales; body robust, ♀ with abbreviated wings; labial palpi thick, porrected.

ARCTIA *Schr.* Euprepia p. *Ochs.* 2 sp. *Ph. caja* L. Donov. pl. 15.
Maxillæ short; wings opake; thorax not crested; basal joint of palpi longer than second, third subacute; body robust.

EUTHEMONIA *Ste.* Euprepia *Ochs.* 1 sp. *Ph. Russula* L. Curt. 21.
Maxillæ short; wings opake; body rather slender; basal joint of palpi shorter than second, third cylindrical.

NEMEOPHILA *Ste.* Chelonia p. *God.* 1 sp. *Ph. Plantaginis* L. Don. 134.
Maxillæ short; wings opake; thorax not crested; palpi very short; basal joint shorter than second, third globose; body rather slender.

HYPERCOMPA *Hub.?* Callimorpha p. *Lat.* 1 sp. *Ph. Dominula* L.
Maxillæ much longer than head; wings densely squamose; antennæ ♂ ♀ simple. Donov. 141.

Family 8. *LITHOSIIDÆ* Stephens.

CALLIMORPHA *Latr.* Lithosia p. *Haw.* 2 sp. *Ph. Jacobææ* L. Curt. 499.

Fore wings subtrigonate, not subtruncate; palpi 3-jointed, second and third joints subequal; antennæ ♂ subciliated.

DEIOPEIA *Steph.* Euchelia *Bdv.* 1 sp. *Ph. pulchella* L. Curt. 169.
Fore wings oblong, subtruncate; palpi 3-jointed; labial palpi much longer than the head, last joint short, ovate, hind wings subdiaphanous; antennæ simple ♂ ♀.

EULEPIA *Curt.* Emydia *Bdv.* 2 sp. *Ph. cribrum* L. Curt. 56.
Fore wings oblong, subtruncate; labial palpi 3-jointed, two apical joints equal; maxillæ not much longer than the head; antennæ ♂ bipectinated.

LITHOSIA *Fab.* Ph. Noctua *L.* 10 sp. *Ph. quadra* L. Curt. 36.
Fore wings oblong; labial palpi 2-jointed, basal joint very large.

GNOPHRIA *Steph.* Lithosia p. *Fabr.* 1 sp. *Ph. rubricollis* L. Don. 350. f. 3.
Fore wings oblong; palpi 3-jointed; maxillæ much longer than head; hind wings opake; body short.

SETINA *Ste.* Lithosia p. *Fab.* 3 sp. *Ph. irrorella* F. St. pl. 17. f. 1.
Fore wings subtrigonate; palpi 3-jointed, third joint much shorter than second; hind wings broad; antennæ simple ♂ ♀.

Family 9. *NOCTUIDÆ* Steph.

TRIPHÆNA *Ochs.* Ph. Noctua *L.* 7 sp. *Ph. N. pronuba* L. Curt. 348.
Fore wings bistigmatiferous; palpi ascending; wings incumbent, entire; thorax not crested; body flat; antennæ simple.

CERIGO *St.* Polia D. *Ochs.* 1 sp. *No. texta* Esper. 4. pl. 108. f. 6.
Fore wings rather broad, obtuse, brownish; posterior yellowish; palpi ascending; thorax with a bifid crest behind, and cucullated in front.

LYTÆA *Steph.* Apamæa p. *Ochs.* 1 sp. *No. umbrosa* Hubn. f. 456, 457.
Fore wings horizontal, narrow, shining, with transverse lines; thorax not crested, squamose; palpi slightly ascending.

CHARÆAS *Steph.* Agrotis p. *Ochs.* 9 sp. *No. cespitis* W. V. Hb. f. 428.
Thorax not crested; antennæ ♂ pectinated; maxillæ elongated; palpi very short, porrected, not ascending; wings more or less denticulated.

CERAPTERYX *Curt.* Charæas p. *St.* 1 sp. *Ph. B. Graminis* L. Curt. 451.
Palpi short, ascending; wings obtuse, slightly deflexed; body short; antennæ ♂ pectinated, nearly to the tip.

RUSINA *Steph.* Agrotis p. *Ochs.* 1 sp. *B. ferruginea* Esper. 3. pl. 47. f. 5, 6.
Antennæ ♂ strongly bipectinated, ♀ ciliated; body slender; fore wings broad, rounded at shoulder; palpi ascending; thorax subcrested.

AGROTIS *Hubn.* Bombyx p. *Esper.* 28 sp. *N. segetum* W. V. pl. 1. a. b. f. 3.
Wings horizontal; fore wings tristigmatiferous, entire; palpi ascending; antennæ ♂ pectinated; thorax not crested.

GRAPHIPHORA *Hubn.* Agrotis p. *Ochs.* 20 sp. *Ph. N. C. nigrum* L.
Fore wings horizontal, broad, glossy, bistigmatiferous; palpi ascending; antennæ generally simple, sometimes pectinated in ♂; thorax slightly crested. Esp. 76. 3.

SEMIOPHORA *Steph.* Episema p. *Ochs.* 1 sp. *Ph. N. gothica* L. Hubn. f. 112.
Thorax smooth, woolly, not crested; fore wings elongate, deflexed, posterior short; palpi short; antennæ bipectinated ♂.

ORTHOSIA *Ochs.* Noctua p. *Haw.* 17 sp. *Ph. N. Litura* L. Curt. 237.
Palpi nearly horizontal; thorax robust, woolly, not crested; antennæ pectinated or ciliated ♂; wings slightly deflexed; fore wings elongate.

MYTHIMNA *Steph.* Ph. Noctua *L.* 4 sp. *Ph. N. turca* L. Hub. f. 218.
Body elongate; fore wings broad, acute at tip, slightly deflexed, stigmata obliterated; palpi short, ascending; eyes pubescent; thorax slightly crested; antennæ finely ciliated.

SEGETIA *Steph.* Caradrina p. *Curt.* 2 sp. *N. Xanthographa* W. V. Hb. f. 138.
Wings slightly deflexed; fore wings short, obtuse, rounded behind; antennæ ciliated ♂; palpi slightly ascending; eyes naked.

CARADRINA *Ochs.* Noctua p. *Haw.* 11 sp. *N. cubicularis* W. V. Hb. f. 417.
Body rather slender; wings glossy, slightly deflexed; thorax subcrested; antennæ ciliated ♂; palpi subporrect, slightly ascending.

GRAMMESIA *Steph.* Caradrina p. *Curt.* 2 sp. *N. bilineâ* Hb. Curt. 651.
Palpi short, scarcely ascending; fore wings obtuse, with transverse lines; thorax stout, woolly; antennæ ♂ serrated.

GLÆA *Hubn.* Cerastis *Ochs.* 4 sp. *No. rubricosa* W. V. Curtis, 268.
Body depressed; wings glossy, incumbent, entire; fore wings chestnut-coloured; antennæ simple; palpi very short, horizontal; thorax tufted in front.

SCOPELOSOMA *Curt.* Glæa p. *St.* 1 sp. *Ph. satellitia* Linn. *Curt.* 635.
Fore wings dentate, elongated, incumbent; palpi very broad, scarcely reaching beyond the head, last joint concealed; antennæ setaceous, hirsute.

AMPHIPHYRA *Ochs.* Pyrophila p. *Hb.* 1 sp. *Ph. pyramidea* L. Don. 193.
Palpi recurved above the head, last joint very long; antennæ slightly ciliated; thorax not crested; fore wings denticulated, incumbent.

PYROPHILA *St.* Amphipyra p. *Tr.* 2 sp. *Ph. tragopoginis* Linn. Hb. f. 40.
Palpi recurved, last joint short, stigma wanting; antennæ very slender; wings incumbent, glossy, entire.

DYPTERYGIA *St.* Xylena D. *Ochs.* 1 sp. *Ph. pinastri* L. Don. pl. 347.
Palpi ascending; antennæ very short, simple; thorax with a dorsal crest; wings incumbent; fore wings short, broad, subdentate.

LEMURIS *Hb.* Nænia *Steph.* 1 sp. *Ph. typica* Hb. f. 61.
Palpi rather long, porrect, ascending, the two basal joints clothed with long scales; thorax crested before and behind; wings incumbent, slightly dentate.

XYLINA *Tr.* Xylena p. *Ochs.* 5 sp. *Ph. putris* L. Hb. f. 245.
Fore wings elongate, sublinear, obsoletely dentate, incumbent; thorax crested; palpi short, slender, subhorizontal; antennæ simple.

RHIZOLITHA *Curt.* Noctua *Haw.* 10 sp. *N. Lambda* F. ? Haw. Hb. f. 242.
Palpi porrected horizontally; head tufted; thorax crested; abdomen tufted at tip; fore wings with the hind margin subangulate, incumbent; posterior margin rounded.

LITHOMIA *Hubn.* Xylina *Ochs.* 1 sp. *Solidaginis* Hb. Curt. 683.
Palpi porrected obliquely; third joint slightly exposed at tip; antennæ setaceous; thorax tufted behind; fore wings very closely deflexed, long, narrow.

CALOCAMPA *St.* Xylina p. *Curt.* 2 sp. *Ph. exoleta* L. Curt. 256.
Fore wings long, narrow, incumbent; palpi short, with the last joint concealed; eyes naked; thorax slightly crested; antennæ short, stout.

XYLOPHASIA *St.* Xylena B. *Ochs.* 9 sp. *Ph. polyodon* L. Hb. f. 82.
Body with a large tuft at the tail; fore wings broad, deflexed, hinder margin subdenticulated; palpi slightly ascending, last joint exposed; antennæ slender.

HADENA *Schr.* DIANTHOECIA *Bdv.* 8 sp. *Ph. plebeia* L. Curt. 308.
Fore wings slightly deflexed, with the hind margin subrotundate; antennæ short, simple; head with a frontal crest; thorax slightly crested.

HELIOPHOBUS *Bdv.* HADENA p. *Schr.* 2 sp. *Bom. popularis* F.
Antennæ ♂ strongly bipectinated, elongate, ♀ bristly; maxillæ very short; palpi short, stout, porrected; thorax crested; wings subdenticulated. Donov. pl. 505.

MAMESTRA *Ochs.* NOCTUA p. *Haw.* 11 sp. *Ph. N. Persicariæ* L. Don. pl. 317.
Antennæ simple; forehead densely crested; thorax with a bifid dorsal crest; fore wings subdenticulate, subdeflexed.

EUPLEXIA *St.* PHLOGOPHORA p. *Curt.* 1 sp. *Ph. lucipara* L. Curt. 619.
Fore wings longitudmally folded at rest; eyes naked; thorax with a double posterior crest; abdomen crested; antennæ closely ciliated; palpi subclavate.

HAMA *St.* LUPERNIA *Bdv.* 4 sp. *No. basilinea* F. Hb. f. 427.
Fore wings denticulated, not folded in repose; thorax scarcely crested, woolly; antennæ ciliated, stout; back of abdomen fasciculated.

APAMÆA *Ochs.* GORTYNA p. *Tr.* 9 sp. *Ph. nictitans* L. Donov. 397. f. 3.
Palpi short, subclavate; thorax with a bifid crest in front and behind; fore wings elongate, triangular, subdentate; hind margin obtuse.

MIANA *St.* APAMÆA B. *Ochs.* 7 sp. *Ph. strigilis* L. Hb. f. 95.
Palpi small, slender; head crested; thorax not crested in front, with a crest behind; wings entire, deflexed, anterior elongate, triangular.

CELÆNA *St.* APAMÆA p. *Curt.* 4 sp. *C. Haworthii* St. Curt. 260.?
Palpi porrected obliquely, densely scaly; antennæ ciliated ♂; wings deflexed, entire, anterior obtuse; head tufted; thorax not crested.

SCOTOPHILA *St.* LYCOPHOTIA *Hb.* 1 sp. *N. porphyrea* W. V.
Palpi porrected obliquely; antennæ long, subpectinated ♂; head and thorax not crested; wings entire, deflexed; anterior narrow. Hb. f. 93. 473.

ACHATIA *Hb.* ILARUS p. *Bdv.* 1 sp. *N. piniperda* Kob. Curt. 117.
Palpi minute, concealed; last joint concealed; head minute; thorax large, downy; antennæ short, subserrated; abdomen short, stout, pubescent.

HAPALIA *Hb.* ACTEBIA *St.* 1 sp. *Ph. N. Præcox* L. Curt. 539.
Head small, with a thick frontal crest; thorax small, subcrested behind; fore wings very narrow, linear, glossy, deflexed; antennæ slender, ciliated ♂.

TRACHEA *Ochs.* NOCTUA p. *Haw.* 1 sp. *Ph. atriplicis* L. Curt. 631.
Fore wings elongate, triangular, deflexed, subdenticulate; antennæ simple; pubescent ♂; head crested; thorax crested before and behind.

VALERIA *Germ.* MISELIA p. *Hb.* 1 sp. *B. oleagina* W. V. Donov. 439.
Antennæ bipectinated in both sexes; palpi short; fore wings crenated; thorax slightly crested.

MISELIA *Ochs.* POLIA p. *Bdv.* 5 sp. *Ph. Aprilina* L. Curt. 177.
Palpi short, porrected obliquely; antennæ subpectinated ♂; head crested; thorax large, crested; wings subdeflexed, anterior with the hind margin crenate.

POLIA *Hb.* AGROTIS p. *Ochs.* 13 sp. *Ph. occulta* L. Curt. 248.
Palpi porrected obliquely; antennæ subpectinated, bristly; head with short scales; thorax slightly crested; wings deflexed, anterior elongate, sublanceolate, crenate.

APATELA *Hb.* ACRONYCTA p. *Curt.* 3 sp. *Ph. Leporina* L. Donov. 327.
Palpi porrected; antennæ simple; head tufted; thorax not crested; fore wings deflexed, elongate, triangular, acute at apex; larvæ very hairy.

ACRONYCTA *Ochs.* APATELA p. *Hb.* 13 sp. *Ph. Psi.* L. Curtis, 136.
Palpi moderate, porrected obliquely; antennæ slightly pubescent ♂; thorax not crested; fore wings entire, deflexed, rounded at the apex; larva fasciculated.

BRYOPHILA *Ochs.* POECILIA *Sch.* 2 sp. *N. perla* W. V. Hb. f. 25.
Body slender; palpi slender; antennæ pubescent ♂; thorax not crested; abdomen slightly tufted; fore wings subdeflexed, broad, elongate, triangular, entire.

DIPTHERA *Hb.* NOCTUA p. *Haw.* 1 sp. *N. Orion* Esp. Curtis, 404.
Palpi porrected obliquely, subclavate; antennæ simple in both sexes; thorax not crested; abdomen tufted on the back; fore wings deflexed, entire; subelongate-triangular.

THYATIRA *Ochs.* NOCTUA p. *Haw.* 2 sp. *Ph. Batis* L. Curtis, 72.
Palpi distant; terminal joint exposed; antennæ short, robust, pubescent; wings ample, anterior deflexed, obtuse, broad, subacuminate at tip; thorax transversely crested.

SCOLIOPTERYX *Germ.* CALYPTRA *Ochs.* 1 sp. *Ph. Libatrix* L.
Palpi elongate, ascending; antennæ ♂ bipectinated; head tufted; thorax with a frontal crest; fore wings deeply notched and emarginate. Donov. 216.

CEROPACHA *St.* TETHEA p. *Curtis.* 7 sp. *N. Or.* W. V. Curtis, 272.
Palpi short, porrect; antennæ short, robust in the middle; head with a frontal tuft; thorax not crested; fore wings deflexed, entire, long.

TETHEA *Ochs.* CYMATOPHORA A. *Tr.* 3 sp. *Ph. retusa* L. Hb. f. 214.
Palpi porrected obliquely; antennæ setose ♂ ♀; head with a frontal tuft; thorax subcrested in front; fore wings deflexed, short, retuse or subemarginate.

BOMBYCIA *Steph.* TETHEA p. *Curt.* 1 sp. *N. viminalis* F. Hb. f. 50.
Palpi very short, porrected subhorizontally; antennæ bipectinated ♂; head tufted in front; thorax not crested; fore wings deflexed, narrow, elongate, rounded at tip.

CYMATOPHORA *Tr.* TETHEA p. *Curt.* 1 sp. *Ph. Oo.* Linn. Donov. 179.
Palpi short, ascending; antennæ bipectinated ♂; thorax robust, woolly beneath; abdomen ♀ conic at tip; fore wings deflexed, entire, obtuse.

COSMIA *Ochs.* NOCTUA p. *Haw.* 5 sp. *Ph. trapetzina* L. Hb. f. 200.
Palpi moderate, ascending; antennæ setose ♂ ♀; head rounded; thorax not crested; fore wings deflexed, subtriangular, subtruncate, or subemarginate at tip.

XANTHIA *Hb.* NOCTUA p. *Haw.* 8 sp. *Ph. fulvago* L. Curtis, 84.
Palpi with the last joint not much exposed; antennæ simple, pubescent; head small; thorax slightly crested; fore wings deflexed, subtriangular, golden coloured.

XANTHOLEUCA *St.* LAMPETIA *Curt.* 1 sp. *No. croceago* W. V. Hb. f 189.
Palpi forming a beak; head conically crested; thorax with a dorsal subconic crest; wings decumbent, anterior rounded at the shoulder, truncate and acute at apex; legs compressed.

GORTYNA *Ochs.* NOCTUA p. *Haw.* 2 sp. *N. flavago* W. V. Curtis, 252.
Palpi short, ascending; antennæ simple, pubescent; head with a dense frontal tuft; abdomen elongate, robust; thorax crested in front; fore wings broad, triangular, subindented.

NONAGRIA *Ochs.* NOCTUA p. *Haw.* 6 sp. *N. Typhæ* Ochs. Curtis, 459.
Palpi nearly vertical; antennæ stout, subserrated; head with a frontal tuft; thorax subcrested; abdomen tufted at tip; fore wings deflexed, narrow, slightly crenated.

LEUCANIA *Ochs.* HELEOPHILÆ *Hb.* 15 sp. *Ph. comma* L. Curt. 157.
Palpi short, ascending; antennæ simple, ciliated ♂; head small; thorax woolly, not crested; abdomen tufted at tip ♂; fore wings incumbent, rather narrow, entire.

SIMYRA *Ochs.* NOCTUA p. *Haw.* 3 sp. *N. nervosa* W. V. Hb. f. 326.
Palpi slightly ascending; antennæ strongly serrated ♂; head small; thorax not crested; fore wings deflexed, broad; apex acute.

PHLOGOPHORA *Tr.* HADENA C. *Ochs.* 1 sp. *Ph. meticulosa* L. Donov. 139.
Palpi ascending, clavate; antennæ long, slender, simple; thorax with an acute crest in front, and a bifid one behind; fore wings longitudinally folded in repose, deeply indented.

CUCULLIA *Schr.* TRIBONOPHORÆ *Hb.* 14 sp. *Ph. verbasci* L. Curt. 45.
Body long; palpi short; antennæ simple; head small, rounded; thorax crested in front; fore wings acute at tip, lanceolate, deflexed; tongue-case of pupa elongated.

CALOPHASIA *St.* XYLINA p. *Tr.* 1 sp. *N. Linariæ* W. V. St. pl. 29. f. 2.
Palpi very short, porrected; maxillæ very long; antennæ slender, simple; head fasciculated; and thorax acutely crested in front; fore wings deflexed; tongue-case of pupa long.

CHARICLEA *St.* XYLINA p. *Tr.* 1 sp. *Ph. Delphinii* L. Curt. 76.
Palpi short, ascending; antennæ simple, slender; thorax subcrested in front; fore wings deflexed, sublanceolate; anterior tibiæ with two spurs.

EREMOBIA *St.* XANTHIA p. *Curt.* 1 sp. *N. ochroleuca* W. V. Donov. 340. f. 2.
Palpi short, ascending; antennæ very slender, simple; head densely squamose; thorax slightly crested behind; fore wings entire, deflexed, elongate-triangular, rounded at tip.

ABROSTOLA *Ochs.* PLUSIA p. *Hb.* 3 sp. *Ph. triplasia* L. Hb. f. 268.
Palpi rather long, ascending; antennæ simple; head with a frontal crest; thorax with a thick bifid crest; fore wings elongate-triangular; larva 16-footed, fourth pair of feet small.

PLUSIA *Ochs.* PHYTOMETRA 1 *Haw.* 14 sp. *Ph. chrysitis* L. Curt. 731.
Palpi long, ascending; maxillæ very long; antennæ simple; head crested; thorax crested behind; fore wings deflexed, with metallic spots; larvæ 12-footed.

HELIOTHIS *Ochs.* HELIOTHENTES *Hb.* 4 sp. *Ph. dipsacea* L. Curt. 595.
Palpi short, subascending; antennæ rather short; thorax not crested; fore wings elongate-triangular, deflexed, entire; fore tibiæ with two spurs; larvæ 16-footed.

ANARTA *Ochs.* PHYTOMETRA *Haw.* 4 sp. *Ph. myrtilli* L. Curt. 145.
Palpi short, last joint almost obsolete; antennæ alike ♂ ♀, slender; thorax obscurely crested; fore wings deflexed, sublanceolate, or subtriangular; larva 16-footed.

ACONTIA *Ochs.* PHYTOMETRA *Haw.* 5 sp. *N. solaris* W. V. Steph. pl. 29. f. 3.
Palpi short, ascending, last joint distinct; antennæ alike ♂ ♀, pubescent; thorax slightly crested; wings deflexed, entire, rhomboidal; larva fusiform.

EUPHASIA *St.* ACONTIA p. *Curt.* 1 sp. *Ph. catæna* Sow. Curt. 276.
Palpi short; antennæ simple; fore wings elongate-lanceolate, entire, rounded behind; head broad; thorax smooth.

ERASTRIA *Ochs.* EROTYLA p. *Hb.* 8 sp. *Ph. sulphuralis* L. Curt. 140.

Body slender; palpi porrected obliquely; antennæ simple, finely ciliated; thorax not crested; fore wings horizontal, forming a triangle.

ACOSMETIA *Steph.* ANTHOPHILA p. *Ochs.* 5 sp. *N. caliginosa* Curt. 356.
Palpi short, last joint minute; antennæ slightly pectinated ♂; head with a small frontal crest; thorax not crested; fore wings elongate-triangular, obtuse at tip, without stigmata.

PHYTOMETRA *Haw.* ANTHOPHILA *Ochs.* 1 sp. *N. ænea* W. V. Hb. f. 350.
Flight semidiurnal; palpi short, terminal joint slender, aciculated; antennæ slender, filiform ♂ ♀; thorax slender, not crested; fore wings entire, subtriangular.

STILBIA *Steph.* PHALÆNA *Haw.* 1 sp. *Ph. anomolata* Haw. Curt. 631.
Body slender; palpi short; antennæ simple, pubescent ♂; thorax not crested; fore wings large, glossy, elongate, sublanceolate, stigmatiferous.

OPHIUSA *Ochs.* ASCALAPHÆ *Hb.* 3 sp. *Ph. lusoria* L. Curt. 475.
Body slender; palpi stout, slightly recurved, last joint scarcely visible; thorax not crested; abdomen tufted at tip ♂; fore wings broad, subtriangular.

CATEPHIA *Ochs.* PHYTOMETRA *Haw.* 2 sp. *Ph. leucomelas* L. Hb. f. 303.
Palpi forming a slight beak; antennæ long, slender, finely pectinated ♂; thorax slightly crested; wings entire, forming a triangle; larva 16-footed.

MORMO *Ochs.* HEMIGEOMETRA *Haw.* 1 sp. *Ph. maura* L. Don. 30. f. 1.
Antennæ simple, pubescent ♂; thorax crested; abdomen crested; fore wings deflexed, forming a triangle, subtriangular; larva ciliated.

CATOCALA *Schr.* BLEPHARA *Hb.* 5 sp. *Ph. nupta* L. Curt. 217.
Palpi porrected obliquely, last joint exposed; antennæ slender; thorax subcrested; fore wings deflexed, forming a large triangle; larva ciliated.

BREPHA *Hb.* HEMIGEOMETRA *Haw.* 3 sp. *Ph. Parthenias* L. Curt. 121.
Palpi very short, concealed; head densely pilose; thorax slender, pilose; fore wings nearly horizontal, entire; larva semigeometrical, 16-footed.

EUCLIDIA *Ochs.* PHYTOMETRA p. *Haw.* 2 sp. *Ph. glyphica* L. Curt. 659.
Palpi rather short, last joint exposed; antennæ short, simple, subpubescent ♂; thorax not crested; fore wings deflexed, entire, short; larva slender, 12-footed.*

Family 10. *GEOMETRIDÆ* Stephens. (Phalæna Geometra *Linn.*, Phalænidæ and Geometridæ *Curtis.*)

Subfamily 1. *Geometrides.*

PSODOS *Tr.* PSYCOPHORA *Kirby.* 2 sp. *G. alpinata* W. V. Curt. 424.
Palpi porrected, very hairy; maxillæ long; antennæ thickened, simple; colours black, or dark; wings short, rounded.

SPERANZA *Curt.* FIDONIA p. *Tr.* 2 sp. *Ph. limbaria* Fab. Curt. 225.
Palpi very scaly; antennæ ♂ slightly pectinated, except at the tip; anterior wings with a small tubercle near the base; colours yellow or fulvous, with a dark border.

FIDONIA *Tr.* BUPALUS? p. *Curt.* 4 sp. *Ph. G. atomaria* L. Donov. 248. 1. 2.
Palpi minute, squamose; maxillæ moderate; antennæ ♂ bipectinated nearly to the tip; wings entire, irrorated.

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* Stephens describes this larva as 16-footed, and Curtis, attempting to correct Stephens in his observations on this genus, states that the larva is 14-footed.

BUPALUS *Leach.* FIDONIA p. *Tr.* 1 sp. *P. G. piniaria* L. Donov. 336.
Palpi very short, hairy; maxillæ very short; antennæ ♂ bipectinated to the tip, ♀ simple; wings erect in repose, anterior with a basal tubercle in ♂.

MŒSIA *St.* BUPALUS p. *Curt.* 1 sp. *G. favillacearia* Tr. Curt. 33.
Palpi distinct, curved; maxillæ short; antennæ moderately pectinated to the tip; wings not tubercled at the base in ♂, deflexed in repose, irrorated ♀, small.

ANISOPTERYX *St.* HYBERNIA p. *Curt.* 2 sp. *G. leucophearia* W.V.
Palpi minute; joints of antennæ ♂ producing a short ciliated twig, or a fascicle of hairs; wings entire in ♂, imperfect in ♀; colour brownish, with transverse streaks. Harr. Aur. pl. 43. m—q.

HYBERNIA *Latr.* LAMPETIA *St. Cat.* 3 sp. *P. G. defoliaria* L. Curt. 703.
Fore wings long and thin in ♂, entirely wanting in ♀; palpi very short; maxillæ nearly obsolete; antennæ ♂ bipectinated to the tip; colour yellowish, with cross streaks.

PHIGALIA *Dup.* AMPHIDASIS p. *Tr.* 1 sp. *G. pilosaria* W.V. Wilkes, pl. 87.
Palpi very short; antennæ with the joints biramose to the tip in ♂, broadest in the middle; wings thin, entire, rudimental in ♀; thorax robust.

NYSSIA *Dup.* AMPHIDASIS p. *St. Cat.* 2 sp. *G. hispidaria* W.V. Curt. 615.
Wings thick, rather small, entire, almost obsolete in ♀; maxillæ obsolete; antennæ strongly bipectinated in ♂, pubescent in ♀; abdomen robust; palpi very hairy.

BISTON *Leach.* AMPHIDASIS p. *Tr.* 3 sp. *Ph. prodromaria* W.V. Don. 219.
Robust: palpi very short, velvety; maxillæ very short; antennæ strongly bipectinated, sometimes to the tip; wings thick, rather small, ♀ winged.

HIMERA *Dup.* METRA *St. Cat.* 1 sp. *P. G. pennaria* L. Don. 287. 2.
Thorax very robust; wings slightly dentate; palpi very short; antennæ ♂ very strongly bipectinated, ♀ subserrated.

CROCALLIS *St.* GEOMETRA p. *Hb.* 1 sp. *P. G. elinguaria* L.
Palpi rather projecting; maxillæ entirely wanting; wings rather broad, slightly denticulate; antennæ shortly bipectinated to the tip. Albin, 39. f. 63. e—h.

ODONTOPERA *Steph.* ENNOMOS D. p. *Tr.* 1 sp. *P. G. bidentata* L.
Palpi distinct; maxillæ elongated; antennæ ♂ bipectinated, ♀ subserrated; thorax stout; wings subdeflexed, deeply dentate and ocellated. Harr. A. 10. s—z.

GEOMETRA *Leach.* ENNOMOS *Curt.* 14 sp. *G. erosaria* W. V. Curt. 667.
Palpi rather long; maxillæ short; antennæ ♂ bipectinated to the tip; thorax robust; wings angulated and indented, elevated in repose.

PERICALLIA *St.* GEOMETRA p. *Hubn.* 1 sp. *P. G. Syringaria* L. Don. 181.
Antennæ bipectinated in both sexes; palpi and maxillæ rather short; wings deflexed, anterior wings retuse, subdentate, posterior rounded, irregularly dentate.

ANGERONA *Dup.* HIPPARCHUS p. *Curt.* 1 sp. *P. G. prunaria* L.
Palpi very short, remote; antennæ bipectinated in ♂, simple in ♀; thorax narrow; anterior wings rounded, entire, covering the posterior, which are irregularly emarginate. Donov. pl. 27.

RUMIA *Dup.* ENNOMOS D. p. *Tr.* 1 sp. *P. G. Cratægata* L. Harr. A. 29. g—l.
Palpi short; maxillæ long; antennæ subserrated in ♂, simple in ♀; thorax slender; wings partially expanded in repose, entire, posterior angular in the middle; larva 14-footed.

OURAPTERYX *Leach.* Acæna *Tr.* 1 sp. *P. G. Sambucaria* L. Curt. 508.
Antennæ simple in ♂ ♀; hind wings truncate-caudate, anterior very acute at tip.

CAMPÆA *Lam.* Metrocampa *Latr.* 1 sp. *P. G. margaritaria* L. Don. 543.
Palpi very short; maxillæ long; antennæ slightly bipectinated in ♂; thorax slender; wings partially expanded, hinder margin angular; larva 12-footed.

ELLOPIA *St.* Campæa p. *Lam.* 1 sp. *P. G. fasciaria* L. Hb. f. 446, 447.
Palpi very short; maxillæ elongate; antennæ ♂ bipectinated, ♀ pubescent; thorax slender; wings slightly expanded, hinder margins rounded; larva 12-footed.

HIPPARCHUS *Leach.* Geometra p. *Hub.* 1 sp. *P. G. papilionaria* L.
Palpi distinct, approximating; maxillæ moderate; antennæ slightly pectinated, subserrate at tip in ♂, simple in ♀; wings green, deltoid in repose, anterior entire, posterior denticulate. Curt. 300.

HEMITHEA *Dup.* Hipparchus p. *Curt.* 3 sp. *P. G. vernaria* L. Curt. 300.
Palpi short, slender, remote; antennæ slightly pectinated, subserrated at tip in ♂; thorax slender; wings deltoid, anterior acute at tip, posterior sometimes angular.

CHLORISSA *St.* Hipparchus p. *Leach.* 4 sp. *P. G. viridata* L. Alb. f. 80. a. c.
Palpi slender; maxillæ rather long; antennæ short, ciliated in ♂, subpubescent in ♀; wings entire, deltoid in repose, apex acute, posterior angulated; posterior tibiæ ♂ thick.

CLEORA *Curt.* Boarmia p. *Tr.* 5 sp. *G. Bajularia* W. V. Curt. 88.
Palpi distinct, scaly, obliquely porrected; maxillæ nearly as long as antennæ, which are bipectinated in ♂, but simple at tip; wings partially extended, anterior entire, posterior subdentate.

EPHYRA *Dup.* Cyclophora *St.* 8 sp. *P. G. porata* L. Curt. 447.
Palpi slender, drooping; maxillæ long; antennæ bipectinated in ♂, terminal half simple; thorax slender; wings slightly expanded, ocellated, anterior with the apex acute, posterior subangulate.

ALCIS *Curt.* Boarmia p. *Tr.* 10 sp. *P. G. repandata L.* Curt. 113.
Palpi porrected, obtuse; maxillæ moderately long; antennæ ♂ bipectinated, simple at tip; thorax slender; wings horizontal, anterior entire, posterior dentate.

HEMEROPHILA *St.* Acidalia p. *Tr.* 1 sp. *P. abruptaria* Thunb.
Palpi short, subclavate; maxillæ rather short; antennæ bipectinated, except at the tip, in ♂, which is serrated; wings expanded, deeply indented, anterior angulated. Donov. 251. 1.

BOARMIA *Tr.* Geometra p. *Hubn.* 7 sp. *G. abietaria* W. V. Curt. 280.
Palpi and maxillæ short; antennæ ♂ pilose, ♀ simple; thorax small; wings horizontal in repose, speckled, anterior entire, posterior dentate.

HALIA *Dup.* Grammatophora *St. Cat.* 1 sp. *P. G Vauaria* L. Don. 196.
Palpi short, basal joint very long; wings short, triangular, pulverose, anterior entire, posterior subdentate; antennæ ♂ bipectinated, terminal joints simple; maxillæ long.

NUMERIA *Dup.* Azinephora *St. Cat.* 1 sp. *P. G. pulveraria* L.
Palpi distant, projecting; maxillæ short; antennæ bipectinated, except at the tip, in ♂, serrated in ♀; thorax slender; wings entire, pulverose. Harr. A. 42. o.

CABERA *Ochs.* Aspilates p. *Curt.* 3 sp. *P. G. pusaria* L. Harr. A. 44. h.

Palpi very short, scarcely projecting; maxillæ rather long; antennæ ♂ pectinated except at the tip; thorax slender; wings partially extended, entire, and rounded at hind margin.

BRADYEPETES *St.* ENNOMOS B. p. *Tr.* 1 sp. *P. G. amatoria* L. Don. 33. 2.
Palpi distant, slender; maxillæ rather long; antennæ ♂ bipectinated nearly to the tip; wings partially expanded, anterior acute at tip, posterior subcaudated.

EPIONE *Dup.* BRADYEPETES p. *St. Cat.* 3 sp. *P. G. vespertaria* L.
Palpi very short; maxillæ long; antennæ ♂ bipectinated to the tip; wings slightly extended, anterior acute at tip, posterior rounded, emarginate near the apex. Hb. f. 43, 44.

EURYMENE *Dup.* BRADYEPETES p. *St. Cat.* 1 sp. *P. G. dolabraria* L.
Maxillæ rather long; antennæ ♂ slightly bipectinated nearly to the tip; wings partially expanded, anterior narrow, angulated, subtruncate, posterior large, excised towards the anal angle. Donov. 349. 1.

ASPILATES *Tr.* CABERA p. *Tr.* 4 sp. *P. G. purpuraria* L. Curt. 467.
Palpi rather long; maxillæ short; antennæ short, bipectinated to the tip ♂, subserrated in ♀; wings entire and rounded, all of nearly equal size.

PHASIANE *Dup.* ASPILATES *St. Cat.* 1 sp. *Ph. plumbaria* F. Hb. fig. 221.
Palpi long, horizontal; maxillæ long; antennæ ♂ slightly bipectinated nearly to the tip, subserrate ♀; wings entire, hinder margin rounded, apex of anterior acute.

LARENTIA *St.* EUBOLIA *Dup.* 4 sp. *P. G. chenopodiata* L. Curt. 707.
Palpi rather long, beak-like; maxillæ long; antennæ ♂ slightly bipectinated to the tip, ♀ subserrate; thorax slender; wings partially expanded, entire, nearly equal, anterior acute at tip.

VENUSIA *Curt.* ——— 1 sp. *V. Cambrica* Curt. 759.
Palpi very short; maxillæ apparently not so long as the antennæ, which are rather short, bipectinated ♂; anterior wings subtrigonate-ovate, posterior trigonate-ovate.

CIDARIA *St.* ZERYNTHIA p. *Curt.* 13 sp. *P. G. didymata* L. Curt. 296.
Palpi short, slender; maxillæ rather long; antennæ ♂ slightly bipectinated nearly to the tip; wings short, deltoid, subtrigonate, entire, anterior slightly acute at tip.

HARPALYCE *St.* ZERENE p. *Curt.* 12 sp. *G. fulvata* W. V. Hb. 297.
Palpi short, acute; antennæ simple, ciliated in ♂; wings short, deltoid in repose, anterior trigonate, outer margin more or less angulated, posterior rounded.

ANTICLEA *St.* CIDARIA p. *Tr.* 4 sp. *G. derivata* W. V. Hb. 289.
Palpi very short; maxillæ rather short; antennæ simple, compressed at base ♂; wings rather broad, short, rounded, and subdentate at the hind margin.

POLYPHASIA *St.* ELECTRA p. *Curt.* 8 sp. *Ph. centum notata* F. Hb. 445.?
Palpi rather long; maxillæ long; antennæ simple, pubescent beneath in ♂; wings deltoid during repose, hinder margin entire, posterior ovate-triangular.

LAMPROPTERYX *St.* ELECTRA p. *Curt.* 3 sp. *G. suffumata* W. V. Hb. 306.
Palpi very short, and maxillæ moderately long; antennæ ♂ with the joints produced beneath, and furnished with a row of hairs; fore wings glossy, long, subdentate.

STEGANOLOPHIA *St.* CIDARIA p. *Tr.* 1 sp. *P. G. prunata* L. Don. 233. 1.
Palpi and maxillæ of moderate length; antennæ simple in both sexes; wings

entire, deltoid in repose, anterior acute at the tip, and furnished beneath at the base with a tuft of hairs.

ELECTRA *St.* CIDARIA p. *Tr.* 6 sp. *P. G. comitata* L. Curt. 603.
Palpi rather long; maxillæ long; antennæ simple, subserrate beneath in ♂; wings entire, deltoid in repose, anterior elongate-trigonate; abdomen ♂ elongate.

CELINA *St.* LARISSA p. *Curt.* 1 sp. *G. imbutata* Curt. 324.
Palpi and maxillæ short; antennæ simple, strongly pubescent ♂; wings entire, deltoid in repose, anterior sublanceolate.

SIONA *Dup.* IDAËA A. *Tr.* 1 sp. *P. G. dealbata* L. Curt. 691.
Palpi rather long, scaly; maxillæ very long; antennæ simple, pubescent ♂; wings entire, with strong dark nerves, posterior margin rounded.

ABRAXAS *Leach.* ZERENE p. *Tr.* 3 sp. *P. G. grossulariata* Curt. 515.
Palpi not visible from above; maxillæ small; antennæ simple, ciliated ♂, pubescent ♀; wings broad, entire, rounded, expanded in repose.

MELANIPPE *Dup.* ZERENE p. *Tr.* 1 sp. *P. G. hastata* L. Don. 129. f. 1, 2, 3.
Palpi remote, short, acute; maxillæ long; antennæ simple, faintly pubescent ♂; wings ample, entire, rounded.

ZERENE *Tr.* GEOMETRA p. *Hb.* 6 sp. *P. G. albicillata* L. Curt. 643.
Palpi not visible from above, remote; maxillæ very long; antennæ slender, simple, slightly pubescent ♂; wings entire, rounded.

EUTHALIA *St.* YPSIPETES *St. Cat.* 4 sp. *P. G. miata* L. Don. 479. 3.
Palpi elongate, beak-like, acute; maxillæ rather long; antennæ simple, slightly pubescent ♂; thorax with a bifid crest behind; wings entire, rounded.

PHIBALAPTERYX *St.* ASPILATES *Curt.* 7 sp. *G. tersata* W. V. Curt. 623.
Palpi short, subclavate; maxillæ long; antennæ robust, subserrated ♂, simple ♀; wings entire, deltoid in repose, anterior elongate-sublanceolate, very acute at tip.

SCOTOSIA *St.* ACIDALIA p. *Tr.* 3 sp. *G. Rhamnata* W. V. Hb. 271.
Palpi long, beak-like; maxillæ rather long; antennæ simple, subpubescent ♂; wings deltoid in repose, anterior subindented, posterior deeply crenate on hind margin.

TRIPHOSA *St.* ACIDALIA p. *Tr.* 3 sp. *P. G. dubitata* L. Don. 246. 2.
Palpi moderate, beak-like; maxillæ long; antennæ ♂ simple, slightly pubescent; wings glossy, deltoid in repose, anterior sinuated, posterior indented on hind margin.

CAMPTOGRAMMA *St.* ACIDALIA p. *Tr.* 1 sp. *P. G. bilineata* L.
Palpi rather long, beak-like, acute; maxillæ rather long; antennæ simple, subpubescent ♂; wings deltoid in repose, hinder margin waved. Donov. 287. 3.

EUCOSMIA *St.* ACIDALIA p. *Tr.* 1 sp. *P. G. undulata* L. Donov. 342. 3.
Palpi moderate, not beak-like; antennæ ♂ simple, subpubescent; fore wings with the hind margin waved, posterior indented, the inner margin with a bunch of hairs.

CHARISSA *Curt.* GNOPHOS p. *Tr.* 5 sp. *G. obscuraria* W. V. Curt. 105.
Palpi short, compressed in ♂; maxillæ long; antennæ ♂ compressed, subpubescent beneath; wings deltoid in repose, anterior subcrenate, posterior indented.

PACHYCNEMIA *St.* FIDONIA p. *Tr.* 1 sp. *G. Hippocastanaria* Hb.
Palpi moderate; maxillæ very long; antennæ slightly pubescent ♂; wings entire,

anterior elliptic, posterior oval; posterior tibiæ dilated with a fascicle of hairs. Curt. 611.

LOZOGRAMMA *St.* Larissa p. *Curt.* 1 sp. *G. petraria* Hb. f. 113.
Palpi very short, acute; maxillæ long; antennæ subpubescent ♂; wings entire, anterior broad-triangular, posterior ovate-triangular; posterior tibiæ with a fan of hairs.

ANAITIS *Dup.* Aplocera *St. Cat.* 2 sp. *P. G. plagiata* L. Donov. 233. 2.
Palpi long, approximating, beak-like; maxillæ long; antennæ simple, subpubescent ♂; wings entire, deltoid in repose, anterior acute.

APLOCERA *St.* Larentia p. *Tr.* 2 sp. *G. cæsiata* W. V.
Palpi short, acute; maxillæ rather short; antennæ perfectly simple; wings ample, entire, hind margin rounded; abdomen long, slender. Hb. 275., and Curt. 324.

CHESIAS *Tr.* Phalæna p. *F.* 2 sp. *Ph. spartiata* F. Donov. 342. 2.
Palpi long, beak-like, acute; maxillæ moderate; antennæ simple, subcompressed, subpubescent; wings entire, glossy, anterior ovate-lanceolate; legs simple.

THERA *St.* Chesias p. *Tr.* 5 sp. *P. G. juniperata* L. Curt. 519.
Palpi rather short, acute at tip; maxillæ moderately long; antennæ subpubescent or slightly bipectinated in ♂; anterior wings ovate-triangular; posterior ample, oval.

OPORABIA *St.* Acidalia p. *Tr.* 1 sp. *G. dilutata* W. V. Donov. 517.
Palpi minute, not visible from above; maxillæ short; antennæ serrated and pilose ♂; wings ample, thin, anterior rounded, posterior subovate.

CHEIMATOBIA *St.* Hybernia p. *Curt.* 2 sp. *P. G. brumata* L.
Palpi very minute; maxillæ very short; antennæ slender, pubescent ♂; wings ample, thin, entire; females nearly apterous; legs simple. Hb. 415. 509.

LOBOPHORA *St.* Chesias p. *Tr.* 7 sp. *Ph. hexapterata* F. Curt. 81.
Palpi short, subacute; maxillæ moderate; antennæ ♂ subpubescent; wings entire, horizontal in repose, anterior elongate-lanceolate, posterior with a lobe in the males.

EUPITHECIA *Curt.* Larentia p. *Tr.* 36 sp. *P. G. rectangulata* L.
Palpi rather long; maxillæ moderate; antennæ ♂ simple, pubescent; wings horizontal in repose, hind margins rounded; anterior elongate-lanceolate; posterior small, ovate. Curt. 64.

MINOA *Tr.* Tanagra *God.* 2 sp. *P. G. chærophyllata* L. Donov. 253. 4.
Palpi very short, compressed; antennæ robust, long, ♂ slightly pubescent; wings erect in repose, entire, rounded, unicolorous.

CLEOGENE *Dup.* Minoa p. *St. Cat.* 1 sp. *G. tinctaria* Hb. ? Hb. 121. ?
Palpi very short, velvety, acute; maxillæ very long; antennæ bipectinated ♂, simple ♀; wings rounded, unicolorous; legs slender.

BAPTA *St.* Corycia *God.* 2 sp. *P. G. bimaculata* Vill. Hb. 90.
Palpi short, obtuse; maxillæ long; antennæ simple, short; wings ample, entire, hinder margin rounded.

EMMELESIA *St.* Melanippe p. *Curt.* 19 sp. *G. rivulata* Hb. Curt. 416.
Palpi short, acute; maxillæ rather long; antennæ simple, sometimes pubescent in ♀; wings entire, deltoid in repose, hinder margin rounded, posterior sometimes angulated.

STRENIA *Dup.* Arte *St. Cat.* 1 sp. *P. G. clathrata* L. Donov. 248. 2.
Palpi short; maxillæ rather long; antennæ simple, pubescent in ♂; wings del-

toid in repose, with many longitudinal and transverse marks; posterior subangulated.

VENILIA *Dup.* ARTE *St. Cat.* 2 sp. *P. G. macularia* L. Curt. 647.
Palpi short; maxillæ long; antennæ simple; wings deltoid in repose, hind margin of anterior excised, posterior subemarginate, maculated.

HYRIA *St.* FIDONIA p. *Tr.* 1 sp. *G. auroraria* Hb. Curt. 523.
Palpi very short; antennæ ♂ slightly serrated and pubescent; wings entire, very rounded at tip; hind tibiæ ♂ without spurs, ♀ with two apical spurs; larvæ very slender.

PTYCHOPODA *St.* GEOMETRA p. *Hb.* 11 sp. *P. G. lividata* L.
Palpi short, slender; maxillæ long; antennæ ♂ ciliated; hind margin of wings entire, horizontal in repose, posterior subsinuated; posterior tibiæ thickened, and often with a long brush of hairs in ♂. St. pl. 31. f. 1.

ACIDALIA *Tr.* DOSITHEA *Dup.* 11 sp. *P. G. aversata* L. Curt. 384.
Palpi very short; maxillæ long; antennæ simple, ciliated in ♂; wings entire, partially expanded in repose; posterior tibiæ often thickened and spurless, or with only one pair of spurs in ♂.

TIMANDRA *Steph.* PHALÆNA p. *Haw.* 4 sp. *Ph. variegata* Scop. Hb. 109.
Palpi moderate; maxillæ rather long; antennæ slightly pectinated to the tip ♂; wings entire, apex very acute, posterior acutely angulated.

PŒCILOPHASIA *St.* ABRAXAS p. *Curt.* 1 sp. *P. G. marginata* L.
Palpi very short, slender; maxillæ long; antennæ short, simple, subpubescent ♂; wings expanded in repose, hind margin of anterior nearly straight, of posterior subemarginate. Don. 293. 2.

PELLONIA *Dup.* MACARIA p. *Curt.* 1 sp. *P. G. vibicaria* L. Hb. 50.
Palpi obtuse; maxillæ long; antennæ very long, bipectinated ♂; wings entire; legs very long; larva 10-footed.

MACARIA *Curt.* ENNOMOS p. *Tr.* 6 sp. *P. G. notata* L. Curt. 132.
Palpi short, obtuse; maxillæ short; antennæ ♂ long, subcrenated, pubescent ♀; wings entire, horizontal in repose, anterior slightly excised, posterior angulated; hind tibiæ fasciculated ♂.

ANIA *St.* MACARIA p. *Curt.* 2 sp. *P. G. emarginata* L. Don. 493. 3.
Palpi short, slender; maxillæ short; antennæ ♂ subserrated and ciliated; wings horizontal in repose, anterior acute, hind margin produced, posterior angulated, sinuous.

Subfamily 2. *Platyptericides* Westw.

AVENTIA *Dup.* ENNOMOS *Tr.* 1 sp. *Ph. flexula* Fab. Hb. f. 19.
Palpi rather long; maxillæ elongate; antennæ simple, subpubescent ♂; wings expanded, anterior elongate, with a deep notch near apex, posterior rounded; body rather stout; larva sublacertine.

PLATYPTERYX *Lasp.* FALCARIA p. *Haw.* 1 sp. *P. G. lacertinaria* L.
Fore wings falcate, hind margin denticulate; palpi very minute; maxillæ nearly obsolete; antennæ bipectinated in both sexes. Donov. 251. 2.

DREPANA *Lasp.* F. PLATYPTERYX p. *Curt.* 5 sp. *P. G. falcataria* L.
Fore wings falcate; hind margin entire; palpi minute; antennæ ♂ bipectinated, ♀ ciliated or subpectinated. Curt. 555.

CILIX *Leach.* EUCLEA *Hb.* 1 sp. *Bomb. compressa* F. Donov. 329. 2.
Fore wings not falcate; palpi short, slender; antennæ ♂ slightly bipectinated, ♀ subserrate.

Family 11. *PYRALIDÆ* Leach. (Phalæna Pyralis *Linn.*)

HYPENA *Schr.* Herminia *Latr.* 5 sp. *P. P. proboscidalis* L. Curt. 288.
Palpi two, much longer than the head, compressed, third joint recurved; wings ample, deltoid in repose, anterior subtrigonate-acute, often squamiferous; anterior coxæ very long; antennæ simple.

MACROCHILA *Hb.* Pyralis p. *Curt.* 1 sp. *P. cribralis* Hb. Curt. 527.
Palpi two, very long, porrected, last joint ascending; antennæ ♂ bipectinated; wings abbreviated, anterior subfalcate; anterior tibiæ ♂ thickened, with large fans of hairs.

PECHIPOGON *Hb.* Polypogon p. *Schr.* 1 sp. *P. G. barbalis* L.
Palpi two, very long, porrected, last joint recurved; antennæ ♂ bipectinated; wings entire, anterior rather elongate-triangular; anterior tibiæ ♂ with a large fan of hairs. Harr. A. 43. l. t.

PARACOLAX *Hb.* Polypogon p. *Schr.* 3 sp. *P. derivalis* Hb. Steph. 33. 2.
Palpi recurved, longer than the head, ascending; antennæ ♂ subbipectinate; wings slightly elongate, anterior subtriangular; head tufted; anterior tibiæ ♂ fasciculated.

ÆTHIA *Hb.* Polypogon p. *St. Cat.* 1 sp. *P. emortualis* Hb. Py. 1. 1.
Palpi two, short, pilose, reflexed; antennæ ♂ subbipectinated; wings shortish, hind margin of anterior rounded; legs slender.

Obs. The last four genera form the genus *Polypogon* Schr. in Steph. Cat, and the *G. Pyralis* Curt.

COLOBOCHYLA *Hb.* Madopa *St. Cat.* 1 sp. *Py. salicalis* W. V.
Palpi two, short, slender, porrected horizontally; antennæ slightly bipectinated; wings entire, anterior subtriangular, hind margin dilated. Hb. Py. 1. 3.

SYNAPHE *Hb.* Cledeobia *St.* 1 sp. *Py. angustalis* Hb. Hb. Py. 4. 21.
Palpi four, conspicuous, labial very long, hirsute, depending; antennæ ♂ densely ciliated and pectinated; fore wings very narrow, long; body long, slender.

CLEDEOBIA *St.* Crambus p. *Haw.* 2 sp. *P. albistrigatus* Haw.
Palpi two, long, porrected, longitudinally compressed, third joint very small; antennæ ♂ densely ciliated; head tufted; fore wings elongate-triangular, obtuse at tip.

CAMPTYLOCHILA *St.* Pyralis p. *Haw.* 2 sp. *Py. undulalis* Haw. St. 33. 3.
Palpi two, semicircularly recurved, slender; antennæ ♂ subbipectinated; head not tufted; wings entire, hind margin rounded; maxillæ rather long.

AGLOSSA *Latr.* Crambus p. *Fab.* 4 sp. *Ph. Py. pinguinalis* L. Curt. 455.
Palpi four, labial long, porrected, last joint exposed; maxillæ almost obsolete; antennæ ♂ bipectinated; wings entire, hind margin rounded, deltoid in repose.

PYRALIS *Linn.* Asopia *Tr.* 4 sp. *P. P. farinalis* L. Curt. 503.
Palpi four, labial ascending, compressed, last joint exposed; maxillæ moderate; antennæ ♂ ciliated; wings rather narrow, not pointed, posterior rounded.

HYPSOPYGIA *Hb.* Asopia p. *Tr.* 1 sp. *P. costalis* Fab. Hb. Py. 15. 77.
Palpi two, short, ascending; maxillæ short; antennæ slender ♂, ciliated; wings glossy, deltoid in repose, anterior sublanceolate-triangular; legs moderate.

AGROTERA *Schr.* Asopia p. *Tr.* 1 sp. *P. flamealis* Hb. 15. 99.
Palpi two, short, recurved; antennæ long, slender, ciliated ♂; wings entire, anterior elongate, very acute, posterior subindented; legs very long.

SIMAËTHIS *Leach.* Anthophila *Hb.* 5 sp. *Ph. T. Fabriciana* L.
Palpi two, short, ascending; maxillæ long; antennæ slender, ciliated in ♂; wings broad, wide, anterior retuse, or acute; legs short. Curt. 320.
(Sect. A. Chorevtis *Hb.* *S. Fabriciana.* Sect. B. *P. Myllerana.*)

ANANIA *Hb.* Ennychia p. *Tr.* 1 sp. *G. 8-maculata* L. Donov. 266. 4.
Palpi four, labial porrected, beak-like; maxillæ long; antennæ slender, subpilose; wings entire, anterior acute, elongate-triangular; legs long and slender.

ENNYCHIA *Tr.* Pyrausta p. *Curt.* 4 sp. *P. G. cingulata* L. Curt. 128.
Palpi four, labial beak-like; maxillæ moderate; antennæ simple, pilose beneath; wings entire; anterior rather short; legs slender.

PYRAUSTA *Schr.* Botys p. *Latr.* 6 sp. *P. P. purpuralis* L. Donov. 339. 2.
Palpi four, labial beak-like, last joint concealed by scales; maxillæ long; antennæ very slender, pilose beneath ♂; wings entire, anterior elongate-triangular, acute.

HYDROCAMPA *Latr.* Botys p. *Schr.* 6 sp. *P. G. Potamogata* L. Curt. 495.
Palpi four, labial short, or moderate, dependent or recurved; maxillæ short or moderate; antennæ simple, or slightly denticulated in ♂; wings very narrow, acute, or rounded at tip, posterior ovate-trigonate; legs long; larvæ aquatic.

EUDIOPTIS *Hb.* Diaphania *St. Cat.* 1 sp. *P. lucernalis* Hb. Py. 9. 58.
Palpi four, labial densely squamose, mask-like; maxillæ very long; antennæ simple; wings entire, subhyaline, anterior acute, obliquely truncate; legs long.

EURRHYPARA *Hb.* Botys p. *Latr.* 1 sp. *P. G. urticata* L. Donov. 549. 2.
Palpi four, labial remote, horizontal, maxillæ elongate; antennæ simple; wings deltoid in repose, anterior acute, hinder margin rounded, entire; legs moderate.

MESOGRAPHE *Hb.* Scopula p. *Curt.* 1 sp. *P. P. forficalis* L.
Palpi four, labial drooping, connivent; maxillæ elongate; antennæ slender, simple; wings entire, deltoid, anterior acute, hind margin rounded. Hb. Py. 9. 58.

MARGARITIA *St.* Scopula *Curt.* 30 sp. *P. verticalis* L. Curt. 312.
Palpi four, labial rather short, porrected; maxillæ long; antennæ slender, setaceous; wings entire, perlaceous, anterior sometimes long and slender; legs long, or very long; abdomen long, slender.

NASCIA *Curt.* Margaritia p. *St.* 1 sp. *P. cilialis* Hb. Curt. 559.
Palpi four, labial long, beak-like, subdependent; maxillæ moderate; antennæ slender; fore wings trapezate, apex acute, subfalcate; abdomen rather short.

CYNÆDA *Hb.* Odontia *Dup.* 1 sp. *P. dentalis* Hb. Curt. 563.
Palpi four, labial long, beak-like, porrected; maxillæ very short; wings subdeflexed, anterior rounded at apex, posterior ovate.

NOLA *Leach.* Roeselia *Hb.* 3 sp. *P. T. cucullatella* L. Curt. 428.
Palpi two, labial robust, subdepending; antennæ ♂ bipectinated, simple ♀; wings entire, anterior sublanceolate; abdomen and legs short.

Family 12. *TORTRICIDÆ* Leach. (Phalæna Tortrix *Linn.* Pyralites p. *Latr.* Platyomides *Duponchel.*)

HYPERCALLIA *St.* Tortrix p. *Haw.* 1 sp. *P. T. Christiernana* L
Palpi very long, divaricating, recurved; antennæ moderate; fore wings elongate-triangular. St. 38. 2.

HYLOPHILA *Hb.* HALIAS *Tr.* 2 sp. *P. T. prasinana* L. Curt. 573.
Palpi moderate, slender, porrected; antennæ simple; fore wings green, with pale oblique stripes; larva naked; cocoon boat-shaped.

EARIS *Hb.* HALIAS p. *Curt.* 1 sp. *P. T. clorana* L. Hb. Tor. 25. 160.
Palpi short, ascending, rather stout, scaly; antennæ simple; wings short, anterior green, with pale margins, triangular; larva naked; cocoon boat-shaped.

TORTRIX *Linn.* PYRALIS *Fab.* 5 sp. *P. T. viridana* L. Curt. 763.
Palpi short, subhorizontal, or drooping, second joint tumid; antennæ simple, slightly pubescent ♂; wings broad, anterior rounded at the shoulder, posterior large; larva concealed in a rolled up leaf.

LOZOTÆNIA *St.* TORTRIX p. *Curt.* 28 sp. *Py. Forsterana* Fab.
Palpi short, horizontal, or slightly ascending; antennæ subpubescent ♂; wings entire, anterior elongate-triangular, hind margin repanded with oblique marks. Albin. 62. a—d.

PHILEDONE *Hb.* AMPHISA *Curt.* 2 sp. *P. Gerningiana* F. Curt. 209.
Palpi moderate, porrected horizontally, apical joint drooping; antennæ bipectinated in ♂; wings deflexed in repose, anterior obliquely truncate at tip; costa subemarginate; abdomen slender.

DITULA *St.* PÆDISCA *Tr.* 9 sp. *T. profundana* W. V. Curt. 571.
Palpi ascending, broad, very squamose; antennæ simple in both sexes; thorax with a bifid crest behind; wings subdeflexed, anterior with the hind margin somewhat rounded.

ANTITHESIA *St.* PENTHINA p. *Tr.* 9 sp. *T. corticana* Hb. Curt. 567.
Palpi short, ascending, very squamous; antennæ simple; thorax with a bifid crest behind; wings deflexed, anterior black and white, rounded at hind margin.

SPILONOTA *St.* PYRALIS p. *Fab.* 17 sp. *P. T. cynosbatella* L. Curt. 551.
Palpi short, subhorizontal, clavate; antennæ simple; thorax not crested; wings deflexed, anterior rather narrow, inner margin with a white blotch in the middle.

HEUSIMENE *St.* TORTRIX p. *Hb.* 1 sp. *T. fimbriana* Haw.
Palpi short, clavate, last joint concealed; antennæ simple; thorax not crested; wings deflexed, anterior elongate, slender, with a notch on hind margin. Hb. To. 7. 362.

PSEUDOTOMIA *St.* ZEIRAPHERA *Tr.* 23 sp. *P. T. Strobilella* L.
Palpi moderate, horizontal, densely squamous; antennæ simple; thorax not crested; wings deflexed, anterior rather long, apparently cleft on hind margin. Hb. To. 8. 46.

STEGANOPTYCHA *St.* TORTRIX p. *Haw.* 12 sp. *P. Bæberana* F.
Palpi moderate, clavate; antennæ simple; males with a tuft at base of fore wings beneath; wings very narrow, linear-triangular, subemarginate at hind margin. Donov. 58. 3. 59. 1.

ANCHYLOPERA *St.* ANCYLIS *Hb.* 12 sp. *P. Lundana* F. Curt. 376.
Palpi moderate, porrected, subhorizontal; antennæ simple, scaly; fore wings slightly falcate, with the costa slightly emarginate, posterior subemarginate.

PHILALCEA *St.* ANTICLEA *St.* 12 sp. *T. ramella* L. Curt. 583.
Palpi short, subclavate, densely squamous; antennæ short, stout in ♂; wings subdeflexed, anterior elongate-triangular, subfalcate at tip, costa straight, posterior entire.

ROXANA *St.* CARPOCAPSA p. *Curt.* 1 sp. *P. T. arcuana* L. Donov. 364. 1.
Palpi moderate, compressed, ascending; thorax subcrested behind; wings de-

flexed, anterior elongate-triangular, hind margin rounded, dark coloured, with silvery lines.

CARPOCAPSA *Tr.* Semasia *St. Cat.* 16 sp. *P. T. pomonella* L. Curt. 352.
Palpi moderate, ascending, subclavate, terminal joint exposed; antennæ simple; wings subconvoluted, anterior elongate-triangular, subfalcate, ocellated near hinder angle.

BACTRA *St.* Aphelia *St. Cat.* 5 sp. *T. pauperana* Haw. Curt. 599.
Palpi moderately long, compressed, densely squamose, terminal joint concealed; wings horizontal, anterior very narrow, hind margin obliquely truncate, acute at tip.

ABLABIA *Hb.* Bactra p. *Curt.* 1 sp. *T. 4-punctata* Haw.
Palpi moderately long, rather slender, last joint long and drooping; wings deflexed, anterior glossy, elongate, entire, hind margin truncate. Hb. To. 36. 227, 228.

CNEPHASIA *Curt.* Pyralis p. *Fab.* 12 sp. *P. T. Logiana* L. Curt. 100.
Palpi shortish, ascending, last joint exposed; antennæ slender; wings deflexed, anterior lanceolate-ovate, posterior triangular-ovate.

SERICORIS *Tr.* Orthotænia *St. Cat.* 18 sp. *T. urticana* Hb. 11. 65.
Palpi short, slightly ascending, densely squamous; antennæ ♂ rather stout, pubescent; wings deflexed, anterior rather broad, hind margin slightly rounded.

NOTOCELIA *Hb.* Aspis *Tr.* 1 sp. *P. T. Udmanniana* L. Donov. 153. 1—3.
Palpi stout, subclavate, terminal joint concealed; antennæ ♂ subserrated; wings entire, anterior broad, short, with a dark blotch near the anal angle.

PŒCILOCHROMA *St.* Spilonota p. *Curt.* 7 sp. *P. T. Solandriana* L.
Palpi horizontal, densely squamous; antennæ ♂ robust, pubescent; wings ample, anterior long and broad, hind margin entire, rounded. St. 4. 36. 1.

PTYCHOLOMA *St.* Tortrix p. *Hubn.* 2 sp. *P. T. Lecheana* L.
Palpi very short, slender, rather ascending; antennæ ♂ robust, pubescent, wings deflexed, anterior slightly rounded behind, costa dilated and reflected at base in ♂, with metallic marks. Hb. To. 11. 67.

EUCHROMIA *St.* Orthotænia p. *Curt.* 2 sp. *T. purpurana* Haw.
Palpi robust, compressed, subclavate, horizontal; antennæ ♂ subpubescent; wings deflexed, anterior without streaks or fasciæ, costa straight, hind margin rounded.

LOPHODERUS *St.* Tortrix p. *Haw.* 2 sp. *T. ministrana* L.
Palpi short, drooping, slender, or slightly ascending; head tufted in front; thorax crested behind; wings deflexed, anterior plain, rounded, slightly dilated at shoulder. Donov. 380. 2.

SARROTHRIPUS *Curt.* Axia *Hb.* 7 sp. *P. Ilicanus* Fab. Curt. 29.
Palpi long, filiform, beak-like; maxillæ long; antennæ slender; thorax crested behind; fore wings dilated at base, costa waved, hind margin rounded, disc with elevated tufts or scales.

PERONEA *Curt.* Lopas *Hb.* 45 sp. *Py. Desfontainiana* Fab. Curt. 16.
Palpi long, porrected, tumid in middle, very squamous; antennæ simple; thorax slightly crested; wings rounded at base, costa emarginate, apex subfalcate, disc with raised tufts or scales.

ACLERIS *Hb.* Paramesia *St. Cat.* 6 sp. *P. T. gnomana* L. Hb. 27. 170.
Palpi short, clavate; antennæ slender, pubescent in ♂; wings entire, retuse, anterior rounded at base, hind margin subemarginate, apex subacute, disc with a few raised scales.

LEPTOGRAMMA *Curt.* OXIGRAPHA *Hb.* 5 sp. *P. T. literana* L.
Palpi horizontal, clavate, thickly squamous; antennæ ♂ rather stout, pubescent; thorax slightly crested behind; fore wings oblong, trigonate, with numerous small tufts. Curt. 440.

TERAS *Tr.* RHACODIA *Hb.* 4 sp. *P. emargana* F. Curt. 699.
Palpi rather long, swollen in the middle; costa of fore wings deeply notched.

DICTYOPTERYX *St.* ALEIMMA *Hb.* 6 sp. *P. T. Læflingeana* L. Donov. 90.
Palpi short, stout, ascending, clavate; antennæ slender, pubescent in ♂; wings subdeflexed, anterior acute or subtruncate, reticulated, costa not ciliated.

CAPUA *St.* N. G. 276. *St. Cat.* 1 sp. *C. ochraceana* St.
Palpi short, somewhat drooping; antennæ short, deeply pubescent; fore wings very short, broad, faintly tessellated, hind margin truncate and entire, costa thick at base in ♂.

CHEIMATOPHILA *St.* TORTRIX p. *Haw.* 1 sp. *T. castaneana* Haw.
Palpi short, slender, horizontal, tumid above; antennæ ♂ slender, subpubescent; wings very glossy, anterior narrow, acute at tip, hind margin subemarginate. St. 36. 3.

ARGYROTOZA *St.* CROESIA p. *Hb.* 5 sp. *P. T Bergmanniana* L.
Palpi very short, clavate, drooping; thorax not crested; antennæ slender; fore wings short, truncate at hinder margin, costa straight, yellow, with silvery lines. Donov. 157. 1—6.

ARGYROLEPIA *St.* COCHYLIS p. *Curt.* 6 sp. *T. Lathamana* Hb. 30. 189.
Palpi short, filiform, horizontal, last joint nearly concealed; wings entire, anterior elongate-triangular, hind margin subtruncate or rounded, disc with silvery markings.

ORTHOTÆNIA *Curt.* ARGYROLEPIA p. *St. Cat.* 6 sp. *P. T. Turionella* L.
Palpi short, horizontal, subclavate, last joint exposed; antennæ ♂ subpubescent; fore wings elongate-triangular, hind margin rounded, with silvery markings. Curt. 364.

RHYACIONIA *Hb.* ZEIRAPHERA p. *Curt.* 1 sp. *P. T. Hastiana* L. Curt. 711.
Palpi short, slender, beak-like; maxillæ very short; wings entire, anterior subelongate-triangular, hind margin obliquely truncate, costa straight.

EUPŒCILIA *St.* COCHYLIS p. *Curt.* 7 sp. *T. angustana* Hb. Donov. 452.
Palpi very short, thick, horizontal; antennæ ♂ thickly pubescent; wings entire fore wings rather narrow, hind margin subobliquely truncate, disc glossy.

PHTHEOCHROA *St.* TORTRIX p. *Hb.* 1 sp. *T. rugosana* Hb.
Palpi very long, slender; maxillæ very short; fore wings rugose, not rounded at the shoulders. Donov. 371. 1.

COCHYLIS *Tr.* TORTRIX p. *Hb.* 5 sp. *T. rubellana* Hb. Curt. 491.
Palpi short, subclavate, very squamose; antennæ ♂ subpubescent; fore wings elongate-triangular, hind margin obliquely truncate, disc with an oblique central dark base.

LOZOPERA *St.* COCHYLIS p. *Curt.* 8 sp. *P. Francillana* F. Donov. 355. 1.
Palpi rather long, subclavate; antennæ ♂ faintly pubescent; wings entire, anterior with the hind margin very obliquely truncate, posterior with the apex produced and angulated.

XANTHOSETIA *St.* PYRALIS p. *F.* 5 sp. *P. T. Zœgana* L. Donov. 106. 2.
Palpi long, horizontal, beak-like, last joint concealed; antennæ ♂ pubescent; wings entire, anterior with the costa straight at base, hind margin slightly rounded.

PHIBALOCERA *St.* PYRALIS *F.* 1 sp. *P. Quercana* F. Donov. 106. 3.
Palpi very long, slender, and recurved; antennæ very long; fore wings triangular and truncated.

ORTHOTÆLIA *St.* ——— 1 sp. *O. venosa* St. St. 35. 3.
Palpi very long, recurved; antennæ short and slender; fore wings sublinear, hind margin subtruncate, costa straight.

Family 13. *YPONOMEUTIDÆ* Steph. (Pyralites p. *Latr.*)

DEPRESSARIA *Haw.* VOLUCRA *Latr.* 24 sp. *P. T. Alstræmeriana* L.
Body broad and depressed; wings horizontally incumbent in repose; palpi recurved, long, apical joint very slender and attenuated; fore wings lanceolate. Curt. 221.

ANACAMPSIS *Curt.* RECURVARIA p. *Haw.* 43 sp. *P. T. Juniperella* L.
Body slightly depressed; palpi very long, recurved, apical joint very long; antennæ rather long, slender; wings incumbent, anterior linear-lanceolate. Curt. 189.

LAVERNA *Curt.* ANACAMPSIS p. *St.* 4 sp. *P. T. sarcitella* L. Curt. 735.
Palpi very long, slender, recurved, second and third joints of equal length; head short, broad; fore wings horizontal, linear-lanceolate, acute at tip, inferior lanceolate.

LOPHONOTUS *St.* ——— 1 sp. *L. fasciculellus* St. St. 39. 1.
Body slender; wings narrow, the anterior subfalcate, with three fascicles of scales on the inner margin.

ACRIA *St.* TINEA p. *Donov.* 1 sp. *P. T. emarginella* Donov. 392. 3.
Palpi divaricating, terminal joint acute; wings entire, anterior rather long, linear, the apex dilated and rounded, and the costa with a circular notch in the middle.

CHELARIA *Haw.* HYPATIMA p. *Hubn.* 1 sp. *P. T. rhomboidella* L.
Palpi two, very long, recurved, divaricating, clothed nearly to the tip; anterior wings very narrow, obtuse, hind wings broad, acute, with very long cilia. Curt. 368.

CLEODORA *St.* RECURVARIA p. *Haw.* 7 sp. *T. silacella* Hb.? Curt. 671.
Body long and slender; palpi two, very long and divaricating, slightly recurved; fore wings long, narrow, cilia rather long, posterior small.

ACAMPSIA *Hb.* TINEA p. *Hb.* 3 sp. *T. tinctella* Hb. Tin. 31. 214.
Palpi very long, slender, recurved, terminal joint very long and acute; head small, glossy; fore wings acutely and obliquely truncate, without markings.

MACROCHILA *St.* APLOTA p. *Curt.* 5 sp. *P. T. bicostella* L. Curt. 655.
Palpi large, divaricating, densely squamous, terminal joint setaceous and acute; antennæ long, slender; fore wings elongate, sublinear, hinder margin subtruncate.

APLOTA *St.* YPSOLOPHUS p. *Haw.* 1 sp. *Y. palpellus* Haw.
Palpi two, elongate, divaricating, clavate, terminal joint nearly concealed; antennæ with fine whorls of hairs; fore wings sublinear, hinder margin obliquely truncate.

ENICOSTOMA *St.* PYRALIS p. *Fab.* 1 sp. *P. Thunbergana* F. Hb. Ti. 35. 288.
Palpi two, much longer than the head, recurved, thickened nearly to the tip, the apex of last joint exposed; wings scarcely deflexed, anterior sublanceolate, with small scaly tufts.

ALABONIA *Hb.* ENICOSTOMA p. *St. Cat.* 1 sp. *P. T. Geoffroyella* L.

Palpi two, nearly as long as the body, very much divaricating, fore wings deflexed, elongate-lanceolate, with metallic lines, posterior with long cilia. Hb. 18. 123.

ŒCOPHORA *Latr.* Dasycerus *Haw.* 2 sp. *T. Oliviella* F. Curt. 408.
Palpi longer than the head, recurved, slender; antennæ stout at the base, densely clothed with scales above, pilose beneath; apex simple, with a pale ring near the tip.

ADELA *Latr.* Capillaria *Haw.* 11 sp. *P. T. De Geerella* L. Curt. 463.
Palpi four, labial slender, recurved; antennæ greatly elongated ♂, thickened in ♀; eyes very large and approximating in ♂; body slender; head pilose; wings metallic.

OPORINIA *Hb.* Diurnea p. *Haw.* 2 sp. *T. Tortricella* Hb. Ti. 2. 11.
Palpi very short, slightly drooping, terminal joint exposed; wings glossy, slightly decumbent, anterior elongate-lanceolate, with one or two patches of scales.

COCHLEOPHASIA *Curt.* Capillaria p. *Haw.* 2 sp. *C. tessellea* H.
Palpi two, very short, drooping; maxillæ wanting; antennæ ciliated ♂; wings in ♂ ample, sublanceolate, smooth, ♀ apterous; larva in a case. Curt. 487.

DASYSTOMA *Curt.* Diurnea p. *Haw.* 1 sp. *T. salicella* Hb. Ti. 2. 9.
Palpi longer than the head, densely hairy; maxillæ obsolete; antennæ ciliated ♂; wings decumbent, anterior sublanceolate, costa curved; female with the fore wings half the length of the body.

OXYPATE *Hb.* Cheimaphasia *Curt.* 1 sp. *P. P. gelatella* L.
Palpi minute, drooping, hairy; maxillæ obsolete; antennæ subpubescent ♂; fore wings ♂ sublanceolate, narrow at base, disc smooth, ♀ with very short wings. Hb. To. 42. 266.

CHEIMOPHILA *Hb.* Diurnea p. *Haw.* 1 sp. *T. phryganella* Hb. Ti. 2. 10.
Palpi rather long, slender, recurved, apical joint subelongate; antennæ ♂ pilose, pubescent; wings smooth, glossy, anterior sublanceolate-truncate, ♀ apterous.

DIURNEA *Haw.* Chimabache *Hb.* 2 sp. *T. Fagella* Fab. Albin. 36. 57. a—e.
Palpi rather long, large, porrected; maxillæ rudimental; antennæ densely pubescent ♂; wings ♂ incumbent, anterior elongated, pale, with irregular markings, ♀ with short acute wings.

SEMIOSCOPIS *Hb.* Epigraphia *St. Cat.* 2 sp. *P. Steinkelnerana* F.
Palpi two, elongate, slender, recurved, subparallel; maxillæ short; antennæ pubescent in ♂; wings decumbent, anterior elongate-lanceolate, pale, with letter-like markings; ♀ winged. Hb. Ti. 4. 26.

ANESYCHIA *Hb.* Melanoleuca *St. Cat.* 4 sp. *P. T. pusiella* L. Curt. 412.
Palpi two, long, slightly recurved, slender, terminal joint much exposed; maxillæ spiral; fore wings obliquely truncate at the hinder margin, pale, with large dark blotches; larvæ solitary.

YPONOMEUTA *F.* Erminea *Haw.* 6 sp. *P. T. padella* L. Donov. 9.
Palpi two, cylindric, nearly horizontal; antennæ subpubescent; wings large, convoluted, anterior long, linear, pale, with minute black spots, rounded; larvæ social.

TELEA *Steph.* Yponomeuta p. *St. Cat.* 8 sp. *P. T. leucatella* L.
Palpi moderate, subfiliform, slightly ascending; antennæ slightly pubescent ♂; fore wings elongate, sublinear, occasionally fasciated; cilia of hind wings large. Hb. Ti. 21. 146.

EDERESA *Curt.* Ismene *St.* 11 sp. *P. T. Pruniella* L. Hb. Ti. 26. 175.
Palpi moderate, slender, subfiliform; antennæ slender; wings convoluted; fore wings elongate-sublinear-lanceolate; apex rounded, posterior wings long and slender.

ARGYROSETIA *St.* Argyresthia *Hb.* 7 sp. *P. T. Goëdartella* L.
Palpi slender, drooping, oblique; maxillæ rather short; antennæ simple; wings convoluted, anterior sublanceolate-linear, with metallic letter-like marks. Donov. pl. 65. 2, 3.

ARGYROMIGES *Curt.* Lyonetia *Hb.* 25 sp. *P. T. Rayella* L. Curt. 284.
Palpi two, very short, drooping, subfiliform; antennæ nearly as long as the wings, which are very narrow, sublanceolate, convoluted, anterior with metallic marks.

HERIBEIA *St.* Tinea p. *Haw.* 5 sp. *T. Forsterella* Fab. St. 39. 2.
Palpi curved and ascending, apex acute; maxillæ very short; antennæ simple; wings subconvoluted, anterior elongate-triangular, hind margin obliquely subtruncate.

MICROSETIA *St.* Tinea p. *Haw.* 27 sp. *T. Stipella* Hubn. Ti. 20. 138.
Palpi rather long, slender, incurved; antennæ simple, subpubescent within in ♂; wings convoluted; anterior elongate-sublinear; cilia short; hind wings slender.

GLYPHIPTERYX *Hb.* Œcophora p. *St. Cat.* 10 sp. *P. T. Linneella* L. Curt. 152.
Palpi slender, drooping, divergent; maxillæ short; wings subdeflexed, anterior sublanceolate-linear, with elongate terminal scales; metallic cilia very long.

PANCALIA *St.* Œcophora p. *Latr.* 6 sp. *P. T. Leuwenhoekella* L. Curt. 304.
Palpi recurved, longer than the head; maxillæ rather long; antennæ setaceous; fore wings subincumbent, lanceolate-linear, with raised metallic spots.

ÆCHMIA *Ochs.* Callisto *St.* 4 sp. *P. T. Fyesiella* F. Donov. 382. 1.
Palpi slender, slightly divaricating, curved upwards; maxillæ short; head smooth; fore wings rather long and narrow, metallic, hind margin subtruncate, posterior sublanceolate.

HARPAGUS *St.* Tinea p. *Haw.* 2 sp. *P. T. cinctella* L. Hb. Ti. 21. 142.
Palpi much longer than head, much recurved, slender at tip, last joint longer than the preceding; fore wings elongate-sublinear, rather rounded behind, black, with a pale central fascia.

ASTYAGES *St.* Butalis *Ochs.* 11 sp. *T. Coracipenella* Hb. Ti. 30. 209.
Palpi not very long, slightly bent, incurved; antennæ simple; maxillæ very short; fore wings narrow, sublanceolate-linear, rarely metallic, immaculate.

CHRYSOCORYS *Curt.* NG. 1099. *St. Cat.* *T. scissella* Haw. Curt. 663.
Palpi slender, subincurved, joints subequal; maxillæ short; antennæ thickened, subserrated in ♂; fore wings very long, sublanceolate, slender, apex acute, subfalcate, posterior narrow.

METALLOSETIA *St.* Damophila *Curt.* 2 sp. *Porr. spissicornis* Haw.
Antennæ with the basal joints dilated and squamose ♂; palpi longish, curved upwards; fore wings brilliant, immaculate, metallic, very long, slender, and acute; cilia long. Curt. 391.

PORRECTARIA *Haw.* Tinea p. *Hubn.* 11 sp. *T. anatipennella* Hb.
Palpi rather short, stout, drooping, or subporrected; antennæ porrected; wings deflexed; fore wings very long, narrow, acute at tip; cilia very long; larvæ in a case. Curt. 687.

APHELOSETIA *St.* Porrectaria p. *Haw.* 12 sp. *T. cygnipennella* Hb.

Palpi moderate, drooping, and incurved; maxillæ short; antennæ stout, subserrated; wings subdeflexed; anterior very short, generally without markings, hind margin oblique. Hb. Ti. 30. 207.

BATIA *St.* Recurvaria p. *Haw.* 6 sp. *T. flavifrontella* Fab. Curt. 543.
Palpi rather long, divaricating, recurved; maxillæ rather long; antennæ pubescent within; wings deflexed; anterior subelongate triangular; hind margin subtruncate.

Family 14. *TINEIDÆ* Steph. (Phalæna Tinea p. *Linn.*)

ACHROIA *Hb.* Galleria p. *Auct.* 1 sp. *G. alvearia* Fab. Hb. Bo. 23. 91.
Palpi four, very short, nearly concealed; thorax and abdomen slender; anterior wings short, sublanceolate, gradually rounded on hind margin; horizontally incumbent.

GALLERIA *Fab.* Ph. Tinea *Linn.* 1 sp. *P. T. cereana* Linn. Curt. 587.
Thorax and abdomen stout; anterior wings emarginate at the apex in ♂, truncate in ♀; palpi dissimilar in the sexes; labial ascending in ♂, drooping in ♀. My fig. 113. 1. ♂.

ILYTHIA *Latr.* Crambus p. *Fabr.* 2 sp. *P. T. colonella* Linn. Don. 263. 2.
Palpi four, concealed, and the labial ones turned up with a terminal spoon-shaped joint in ♂; labial palpi elongated, porrected in ♀; wings convoluted, narrow, with the costa arched in ♂, broad, with a straight costa, in ♀.

SENTA *St.* Meliana *Curt. G.* 2 sp. *M. flammea* Curt. B. E. 201.
Palpi four, maxillary concealed, labial curved upwards, slightly visible from above; antennæ slightly pubescent; wings elongate, anterior sublinear.

EUDOREA *Curt.* Scoparia *Haw.* 11 sp. *P. T. Mercurella* L. Curt. 170.
Palpi four, conspicuous, maxillary small, labial elongated and brush-like, slightly drooping; antennæ subserrate; wings nearly decumbent, anterior longish, subtriangular.

PHYCITA *Curt.* Phycis p. *Fab.* 28 sp. *T. nebulella* Hb. Curt. 233.
Palpi four, maxillary minute, 3-jointed, labial as long as the head, recurved, slender; antennæ ♂ with an ovate mass of scales at base; fore wings fasciated, convoluted in repose, elongate-trigonate, hind margin rounded.

HOMÆOSOMA *Curt.* Phycis p. *Haw.* 1 sp. *P. gemina* Haw.
Palpi four, labial porrected, slender; antennæ simple; wings convoluted, anterior narrow, sublanceolate, subobtuse at hind margin, posterior ample, much folded.

PRIONAPTERYX *St.* ——— 1 sp. *P. nebulifera St.*
Fore wings with three or four deep serratures towards the apex of the costa; antennæ ♂ slightly pectinated.

NOMOPHILA *Hb.* Scopula p. *Curt.* 1 sp. *P. hybridalis* Hb. Py. 17. 114.
Palpi four, labial porrected and ascending, joints concealed by scales; antennæ pubescent in ♂; wings subdeflexed and convoluted, anterior narrow, long, transparent; legs long.

ONCOCERA *St.* Crambus p. *Fab.* 3 sp. *P. T. carnella* L. Donov. 153. 5.
Palpi four, labial elongate, slender, recurved; antennæ ♂ with a mass of scales near the base; fore wings without fasciæ, convoluted, elongate-triangular, subtruncate at apex.

ARAXES *St.* Palparia p. *Haw.* 4 sp. *T. ahenella* Hubn. Ti. 58. 9.
Palpi four, maxillary minute, labial much longer than head, porrected, slender; apex acute; antennæ simple; fore wings subconvoluted, anterior elongate-sublanceolate, hind margin rounded.

CRAMBUS *Fab.* PALPARIA p. *Haw.* 38 sp. *P. T. pascuella* L. Curt. 109.
Labial palpi long, porrected, beak-like, very slender, last joint subdeflexed; fore wings narrow, convoluted, hind margin obliquely truncate or subemarginate; antennæ setaceous. My fig. 112. 14.

CHILO *Zenck. S.* PALPARIA p. *Haw.* 6 sp. *P. T. caudella* L. Curt. 727.
Palpi four, labial as long as the head and thorax, beak-like; fore wings long, lanceolate; apex acute, obliquely truncate, or subemarginate at hind margin; antennæ pubescent or subpectinated ♂.

THERISTES *Hb.* PLUTELLA p. *Schr.* 2 sp. *P. T. nemorella* L. Steph. 40. 1.
Palpi four, labial long, incurved; maxillæ rather long; fore wings subconvolute, very long, acuminate or falcate at tip; antennæ simple, porrected. Curt. 535. descr. gen.

HARPIPTERYX *Hb.* PLUTELLA p. *Schr.* 3 sp. *P. T. scabrella* L. Curt. 535.
Palpi four, labial rather long, with very long scales, the last joint being slender, curved upwards, and rising apparently from the middle of the palpus; fore wings deflexed, anterior narrow; apex falcate, emarginate.

HYPSOLOPHA *Hb.* YPSOLOPHUS p. *Fabr.* 3 sp. *P. T. asperella* L.
Palpi four, labial rather long, directed forwards, beak-like, last joint drooping; antennæ simple; fore wings deflexed, narrow, elongate, sometimes tufted, hind margin deeply excised. Hb. Ti. 15. 101.

CHÆTOCHILUS *St.* CEROSTOMA p. *Curt.* 9 sp. *P. T. sequella* L.
Palpi four, labial rather long, curved upwards, beak-like, last joint slender, recurved, setiform; fore wings incumbent, very long, narrow, lanceolate, posterior sublanceolate. Steph. 40. 2.

CEROSTOMA *Latr.* YPSOLOPHUS p. *Fabr.* 4 sp. *P. T. Xylostella* L.
Palpi four, labial rather long, curved upwards, thickly squamous, last joint setiform; antennæ simple, porrected; fore wings narrow, elongate, rounded behind. Curt. 420.

EUPLOCAMUS *Latr.* PHYCIS p. *Ochs.* 1 sp. *T. mediella* Hb. Curt. 591.
Maxillary palpi as long as the very short maxillæ, 6-jointed, labial turned upwards; antennæ ♂ fasciculated; fore wings rounded at hind margin.

ACROLEPIA *Curt.* ——— 2 sp. *A. Betulatella* Curt. B. E. 679.
Maxillæ nearly as long as the antennæ; max. palpi 3-jointed, short, labial palpi long, slender, recurved; fore wings much deflexed, elongate-sublinear, rounded at apex; cilia short; posterior lanceolate, with long cilia.

TINEA *Auct.* PHALÆNA TINEA p. *L.* 15 sp. *P. T. pellionella* L. Curt. 511.
Head strongly crested in front; maxillary palpi longer than the very short maxillæ, 5-jointed, labial slender, short, straight; fore wings glossy, incumbent, elongate, rounded behind. My fig. 113. 5.

LEPIDOCERA *St.* YPSOLOPHUS p. *Haw.* 4 sp. *T. Taurella* Hb. Curt. 344.
Head rough; palpi and antennæ ♂ clothed with very long clavate scales; wings scabrous, sublinear.

INCURVARIA *Haw.* TINEA p. *Hb.* 5 sp. *T. masculella* W. V. Curt. 607.
Antennæ ♂ strongly pectinated; maxillary palpi incurved, long, 6-jointed; head densely clothed with erect scales.

AMAUROSETIA *St.* TINEA p. *Haw.* 9 sp. *P. T. albinella* L.
Labial palpi rather long, slender, straight, drooping; antennæ simple; fore wings incumbent, elongate-sublinear; cilia short, hind margin rounded. Hb. Ti. 21. 141.

LAMPRONIA *St.* TINEA p. *Haw.* 12 sp. *P. T. capitella* L. Curt. 639.

Maxillæ shorter than the max. palpi, which are 6?-jointed; labial palpi slender, deflexed; antennæ ♂ with diverging hairs; head crested; fore wings deflexed, ample; apex óval; posterior subtriangular.

ERIOCEPHALA *Curt.* Lampronia p. *St.* 10 sp. *P. T. Calthella* L.

Maxillæ very small; max. palpi longer than head, porrected, 5-jointed; labial palpi small; fore wings deflexed, ovate-lanceolate, with many radiating nervures. Curt. 751. My fig. 113. 10.

EUSPILAPTERYX *St.* ——— 1 sp. *E. auroguttella* St.

Maxillary palpi very distinct, slender, curved, deflexed; labial palpi slender, short, incurved; antennæ very long, slender; fore wings deflexed, elongate-linear, posterior lanceolate.

ACENTROPUS *Curt.* { Acentria *St.* / Zancle *St.* } 1 sp. *H. nivea* Oliv. Curt. 497.

Legs entirely without spurs. My fig. 113. 11—17.

GRACILLARIA *Haw.* Alucita p. *Fabr.* 19 sp. *T. Thunbergella* Fab.

Middle tibiæ densely squamous; labial palpi long, very slender, and recurved; maxillary palpi short, slender, diverging; wings very narrow; cilia very long. Curt. 479.

Family 15. *ALUCITIDÆ* Leach. (Pterophorites *Latr.*)

AGDISTES *Hb.* Adactylus *Curt.* 1 sp. *A. Bennettii.* Curt. 471.

Wings entire.

PTEROPHORUS *Geoffr.* Alucita p. *Schr.* 27 sp. *P. A. pentadactyla* L.

Anterior wings 2-, posterior 3-lobed. Curt. 161. My fig. 113. 18.

ALUCITA *Scop.* Orneodes *Latr.* 3 sp. *P. A. hexadactyla* L. Curt. 695.

All the wings 6-lobed.

Order X. HOMOPTERA. (Hemiptera sect. Homoptera *Latr.* Omoptera *Leach.* Hemiptera p. *Linn.* Rhyngota p. *Fabr.*)

Sect. I. Trimera *Westw.* (*Cicada* Linn. *Cicadaires* Latr. *Cicadina* Burm.)

Family 1. *CICADIDÆ* Westw. (Cicadiidæ *Leach.* Cic. manniferæ *Linn.* Chanteuses *Latr.* Stridulantia *Burm.*)

CICADA *Linn.* Tettigonia *Fab.* 1 sp.— *C. anglica* Sam. Curt. 392.

Antennæ 7-jointed; tarsi 3-jointed; ocelli three. (*C. tibialis.* Pz. 59. 5?.)

Family 2. *FULGORIDÆ* Leach. (Fulgorelles *Latr.* Fulgorina *Burm.*)

[PSEUDOPHANA *Burm.* Fulgora p. *Auct.* 1 sp. *F. Europæa* Linn. Donov. pl. 203.]

ISSUS *Fab.* Cercopis p. *Panz.* 1 sp. *I. coleoptratus* Fab. Curtis, 449.

Very broad; hemelytra angularly dilated in the middle of the outer edge; ocelli 0.

CIXIUS *Latr.* { Cixius and G. 1414 *St. Cat.* } 21 sp. *C. cunicularis* L. Curt. 673.

Antennæ shorter than the eyes; second joint nearly globular; ocelli two; abdomen narrow.

ASIRACA *Latr.* DELPHAX p. *Fab.* 4 sp. *A. clavicornis* Fab. Curtis, 445.
Antennæ much longer than the head; basal joint longest, carinated; ocelli 0.

DELPHAX *Fab.* ——— 19 sp. *D. minuta* Fab. Curtis, 657.
Antennæ not longer than the head; basal joint shorter than the second, and entire; ocelli two.

Obs. Criomorphus *Curt.* is composed of partially developed individuals of Delphax.

Family 8. *CERCOPIDÆ* Leach. (Cicadelles *Latr.* Cicadellina and Membracina *Burm.*)

SMILIA *Germar.* CENTROTUS p. *Curt.* 1 sp. *S. Genistæ* L. Curtis, 313.
Tibiæ prismatical, not dilated; tarsi equal; prothorax extended over the abdomen.

CENTROTUS *Fab.* MEMBRACIS *St. Cat.* 1 sp. *C. cornutus* L.
Tibiæ flattened, denticulate at the edge; prothorax extended over the abdomen; scutellum distinct; Donov. pl. 83.

LEDRA *Fab.* MEMBRACIS p. *Oliv.* 1 sp. *L. aurita* Linn. My fig. 116. 1.
Head flat; prothorax lobed at the sides; scutellum exposed; hind tibiæ flat, serrated.

EUPELIX *Germar.* CICADA *Fab.* 1 sp. *C. cuspidata* Fab.
Head very large, flat, and triangular, margined in front; ocelli exposed on the upper surface of the head; hind tibiæ with three rows of spines; thorax simple. Burm. Gen. pt. 2. pl. 3.

PAROPIA *Germ.* MEGOPHTHALMUS *Curt.* 2 sp. *Ul. scanica* Fall.
Head flat, forming a narrow lunule, edge acutely margined; ocelli facial; thorax posterior, tibiæ with a few external spines. Germ. Faun. 11. 11.

ULOPA *Fall.* CERCOPIS *Ahr.* 3 sp. *Ul. Ericæ* Ahr. Burm. Gen. 3. pl. 1.
Very gibbose; wing-covers elytriform; ocelli 0; head very broad, rounded in front, strongly punctate.

CERCOPIS *Fab.* CICADA *Linn.* 1 sp. *C. vulnerata* Rossi. Curtis, 461.
Head small; ocelli apart on the upper side of the head; posterior tibiæ bidentate; prothorax large, hexagonal.

APHROPHORA *Germ.* TETTIGONIA *Oliv.* 2 sp. *C. spumaria* L.
Head moderate; ocelli two, approximate on the crown of the head, posterior tibiæ 2-dentate; prothorax trapezoidal. Pz. 103. 8.

PTYELA *Serv. & St. F.* TETTIGONIA p. *Oliv.* 5 sp. *C. bifasciata* Linn. nec Pz.
Differs from Aphrophora in the ocelli being as wide apart as they are distant from the eyes. Var. C. lateralis *Pz.* 6. 24.

ACUCEPHALUS *Germar.* APHRODES p. *Curt.* 11 sp. *C. trifasciatus* F.
Vertex trigonate, not keeled; ocelli remote, marginal, not immersed in a fovea; prothorax transverse; hind tibiæ multispinose. Curtis, 620.

APHRODES *Curt.* CICADA p. *Don.* 22 sp. *A. costata* F. Curtis, 633.
Suboval; head flat, subtrigonate lunate; thorax transverse; ocelli marginal; hind tibiæ multispinose; anterior pectinated within.

PHRYNOMORPHUS *Curt.* ——— 1 sp. *P. nitidus* Curt.
Oblong shining; head crescent-shaped above; ocelli marginal; thorax transverse; wing-covers indistinctly veined; hind tibiæ thickly spined.

EVACANTHUS *Enc. M.* AMBLYCEPHALUS *Curt.* 7 sp. *A. interrupta* L.
Ocelli placed on the anterior part of the upper side of the head in a sulcus; hypostoma oblong; posterior tibiæ angulated with two rows of spines. Curt. 572.

TYPHLOCYBA *Germ.* Eupteryx *Curt.* 30 sp. *C. Ulmi* Linn. Curtis, 640.
Ocelli 0; hypostoma oblong-subtrigonate; fore wings indistinctly nerved; posterior tibiæ with a double row of spines.

PENTHIMIA *Germ.* *G.* 1425 *St. Cat.* 1 sp. *sanguinicollis* F. Pz. 61. 18.
Wing-covers folding over each other at the tip; hypostoma flat, transverse; ocelli on the crown of the head; hind tibiæ with two rows of spines.

AGALLIA *Curt.* Bythoscopus p. *H. Sch.* 4 sp. *C. venosa* Ahr.
Face ovate, trigonate; head above forming a narrow lunule; ocelli in the forehead; prothorax narrower than the head; wings very much deflexed, apical nervures reticulated; posterior tibiæ spined externally.

IDIOCERUS *Lewis.* Bythoscopus p. *Burm.* 5 sp. *I. stigmaticalis* Lew.
Head broader than the thorax; face subturbinate; ocelli facial; fore-wings membranous, overlapping at the tips; seta of antennæ ♂ clavate. Curt. 738.

BATRACOMORPHUS *Lewis.* Trans. Ent. Soc. vol. i. 1 sp. *B. irroratus* L.
Depressed; head nearly as wide as the thorax; anterior margin very convex; ocelli near superior margin of face; wing-covers slightly deflexed; intermed. tibiæ spined. Trans. Ent. Soc. vol. i. pl. 7. f. 5.

MACROPSIS *Lewis* A. S. G. Pediopsis *Burm.* ... sp. *C. virescens* Fab.
Head as wide as the thorax, anterior margin convex, posterior concave; face subrhomboidal, flat; apex truncate; ocelli facial; antennæ placed in excavations beneath the eyes. Trans. Ent. Soc. vol. i. pl. 7. f. 3.

ONCOPSIS *Burm.* Macropsis B. *Lewis.* ... sp. *C. flavicollis* L.
Differs from the last in having the face tumid, and the prothorax transverse-ovate, notched behind. Trans. Ent. Soc. vol. i. pl. 7. f. 4.

IASSUS *Fab.* Bythoscopus p. *Germ.* 1 sp. *I. Lanio* L. Curtis, 636.
Head very broad and short, base concave; ocelli placed on the forehead between the eyes; thorax transverse-ovate; face broader than long; clypeus oblong; ovipositor recurved.

Obs. The genera Bythoscopus and Iassus have been much confused. Burmeister thus distributes them into subgenera in his *Genera Insectorum:* —

Bythoscopus. 1 A. Bythoscopus (Flata varia *Fab.*). 1 B. Idiocerus *Lewis.*
2 A. Oncopsis (Macropsis B. *Lewis*). 2 B. Pediopsis (Macropsis A. *Lewis*).

Iassus. 1 A. Iassus [N. G. Curtis's Guide] (I. atomarius, cruentatus *Germar, &c.*) 1 B. Athysanus (C. argentatus, histrionicus, &c.). 2 A. Deltocephalus (I. pulicaris *Fall, &c.*). 2 B. Platymetopius (I. vittatus *Fab., &c.*).

Sect. II. Dimera *Westw.* (*Phytophthires* Burm.)

Family 1. (or 4.) *PSYLLIDÆ.* (Faux-Pucerons *Réaumur.* Psyllodes *Burm.*)

PSYLLA *Geoff.* Chermes *Linn.* 27 sp. *C. Pyri* Linn. Curtis, 565.
Head moderately notched in front; antennæ slender; wing-covers membranous.

LIVILLA *Curt.* ——— 1 sp. *L. Ulicis* C. Curtis, 625.
Head very deeply cleft in front; antennæ long, slender; wing-covers convex, coriaceous.

LIVIA *Latr.* Diraphia *Illig.* 1 sp. *Ps. Iuncorum* Latr. Curtis, 492.
Head strongly bifid; antennæ short, dilated at base; wing-covers deflexed, coriaceous.

Family 2. (or 5.) *APHIDÆ* Leach. (Aphidii *Latr.* Aphidina *Burm.*)

APHIS *Linn.* ——— 21 sp. *A. Rosæ* Linn. Curtis, 577.
Abdomen bicorniculate; antennæ long, setaceous; fore wings with three oblique discoidal nerves, the first trifid; proboscis short; collar long.

LACHNUS *Illig.* Cinara *Curt.* 35 sp. *A. Roboris* L. Curtis, 576.
Abdomen bitubercled; antennæ moderate, often filiform; collar short; proboscis long.

ATHEROIDES *Hal.* (Ann. Nat. Hist.) 2 sp. *A. serrulatus, A. hirtellus* Hal.
Apterous, linear, flattened; spiracles of penultimate joint simple; antennæ not longer than half the body; proboscis shorter than the body.

ERIOSOMA *Leach.* Myzoxyle *Blot.* 11 sp. *L. lanigera* Ill.
Abdomen without tubercles or horns; antennæ short, filiform; body woolly; fore wings with simple oblique discoidal nerves.

ADELGES *Vallot.* Aphis p. *De Geer.* 22 sp. *A. Laricis* V.
Legs and antennæ very short, female very much swollen; legs and antennæ scarcely visible; setæ of the mouth very long. (De Geer, *Mém.* tom. iii. tab. 8. Aphis Gallarum Abietis.)

BRYSOCRYPTA *Hal.* Chermes *Burm.* ? sp. *Aph. bursaria* L.
Composed for the reception of those species of Eriosoma, which inhabit closed follicles on the leaves and shoots of plants. Swamm. pl. 45. f. 22—25.

[PHYLLOXERA *Fonscol.* doubtingly introduced by Curtis into his *Guide*, P. Roboris. Fore wings carried flat on the back, with one simple stigmal and two simple oblique discoidal nerves.]

THELAXES *Westw.* ——— 3 sp. *T. Quercicola* Westw.
Wings carried flat on the back at rest, anterior with three oblique discoidal nerves, the anterior bifid; antennæ short.

Family 3. (or 6.) *ALEYRODIDÆ* Westw.

ALEYRODES *Latr.* Phalæna p. *L.* 2 sp. *P. proletella* Linn. My fig. 118. 1.
Wings four, of nearly equal size; eyes on each side divided.

Sect. III. Monomera *Westw.* (*Gallinsectes* Latr. *Coccina* Burm.)

Family 1. (or 7.) *COCCIDÆ* Leach.

DORTHESIA *Bosc.* Cionops *Leach.* 6 sp. *D. Characias* Bosc.
Males with a thick pencil of setæ at the tail; females active, covered with flakes of a waxy secretion. My frontispiece, Vol. I. f. 8. ♂, *fig.* 118. 20. ♀.

ASPIDIOTUS *Bouché.* Coccus p. *Auct.* 3 sp. *A. Genistæ* Westw.
Males very broad, with broad wings, without lateral anal filaments, with a central appendage; puparium with a double shield; females immoveable.

COCCUS *Linn.* Lecanium p. *Burm.* —? sp. *C. aceris* Fab. Curtis, 717. ♂.
Males winged; abdomen with two very long lateral filaments and a shorter central appendage; females large, gibbous, gall-like, fixed to plants (*fig.* 118. 17, 18.)

[LECANIUM *Ill.* (*L. hesperidum Linn.*, Burm. ♀ tab. 1. fig. 11.; and my fig. 118. 19.), having the females flat and shield-like, with short legs and two anal setæ,] and

[PSEUDOCOCCUS *Westw.* (*C. adonidum, Cacti,* &c.), having the females not fixed, and clothed with a woolly secretion, cannot be considered as indigenous.]

ORDER XI. HETEROPTERA. (HEMIPTERA *MacL., Steph.* HEM. HETEROPTERA *Latr.* HEMIMEROPTERA p. *Clv.* RHYNGOTA p. *Fabr.*)

Sect. I. HYDROCORISA *Latr.*

Family 1. *NOTONECTIDÆ* Leach. (Notonectici *Burm.*)

NOTONECTA *Lin.* ——— 3 sp. *N. glauca* L. Curtis, 10.
Cylindric-oval; fore tarsi 3-jointed; hind tibiæ without ungues. (My fig. 119. 1.)

PLOA *Steph.* PLEA *Leach.* 1 sp. *N. minutissima* Fourc. Pz. 2. 12.
Ovate-quadrate; fore tarsi 3-jointed, hind tarsi with ungues.

SIGARA *Leach.* NOTONECTA *L.* 1 sp. *N. minutissima* L.
Anterior tarsi 1-jointed; scutellum distinct.

CORIXA *Geoffr.* SIGARA p. *Fab.* 10 sp. *N. striata* Linn. Donov. pl. 176.
Anterior tarsi 1-jointed; scutellum not distinct.

Family 2. *NEPIDÆ* Leach.

NAUCORIS *Geoffr.* NEPA p. *Linn.* 1 sp. *N. Cimicoides* L. Don. pl. 381.
Body oval, depressed, without anal setæ.

NEPA *Linn.* HEPA p. *Geoffr.* 1 sp. *N. cinerea* L. Curtis, 700.
Body broad, flat, with too long anal setæ. (My fig. 119. 10.)

RANATRA *Fabr.* NEPA p. *Linn.* 1 sp. *N. linearis* L. Curtis, 281.
Body linear, with two long anal setæ.

Sect. II. AUROCORISA *Westw.* (Geoocorisa *Latr.*)

Family 1. (or 3.) *GULGULIDÆ.*

(There is no British species in this family.)

Family 2. (or 4.) *ACANTHIIDÆ* Leach. (Riparii *Burm.*)

APHELOCHEIRUS *Westw.* NAUCORIS p. *Auct.* 1 sp. *N. æstivalis* Fab.
Antennæ very short; hind legs natatorial. My frontispiece, Vol. I. fig. 7.

ACANTHIA *Latr.* SALDA *Fabr.* 10 sp. *Ci. saltatoria* Linn. My fig. 120. 10.
Antennæ of moderate size; legs formed for running. Curtis, 548.

Family 3. (or 5.) *HYDROMETRIDÆ* Leach. (Ploteres *Latr.* Hydrodromici *Burm.* Amphibicorises *L. Dufour.*)

HYDROMETRA { *Latr.* 1796., nec *Fab.* S. Rh. / LIMNOBATES *Burm.* } 1 sp. *C. Stagnorum* L.
Linear, first and second joints of antennæ short, third longest; legs formed for walking. Curtis, 32. (My fig. 120. 6.)

VELIA *Latr.* HYDROMETRA p. *Fab.* 1 sp. *C. Rivulorum* L. Curtis, 2.
Basal joint of antennæ longest; legs moderate, placed at equal distances apart formed for rowing.

MICROVELIA *Westw.* HYDROESSA *Burm.* 1 sp. *V. pygmæa* Duf.
Last joint of antennæ longest, intermediate joints short; legs of equal length, short; thighs simple. Curtis, 681.

GERRIS *Fab.* 1794. HYDROMETRA *Burm. & Fab.* S. R. 6 sp. *C. lacustris* L.
Basal joint of antennæ longest; four hind legs very long, at a great distance from the fore legs. Curtis, 553. (My fig. 120. 2.)

HEBRUS *Walk.* LYGÆUS p. *Fall.* 1 sp. *Lyg. pusillus* Fall.
Ovate, depressed; ocelli two; hind legs curved; tarsal ungues apical; scutellum

distinct; apical membrane veinless. Westw. in *Ann. Soc. Fr.* 1834, pl. 6. fig. 6.

Family 4. (or 6.) *REDUVIIDÆ* Steph. (Reduvini *Burm.*)

REDUVIUS *Fabr.* Opsicætus *Klug.* 1 sp. *R. personatus* Linn.
Antennæ 4-jointed, basal joint short, second long, subclavate, third twice as long as second, fourth as long as all the rest, capillary; proboscis short, stout; eyes large; wings ample. My fig. 120. 15.

CORANUS *Curt.* Collicoris *Hahn.* 1 sp. *C. subapterus* De G. Curt. 453.
Proboscis not reaching beyond the fore legs; antennæ 8-jointed, first, third, fifth, and seventh minute, second longest, fourth and sixth short; eyes small, remote; wings mostly rudimental.

PROSTEMMA *Lap.* Postemma *L. Duf.* 1 sp. *Red. guttula* Fab.
Fore legs thick; femora spined; tibiæ with an apical pulvillus; basal joint of antennæ slightly elongated, second very short, three others long, the third longest; wing-covers sometimes rudimental. Curtis, 684.

PYGOLAMPIS *Germar.* Ochetopus *Hahn.* 1 sp. *P. denticulatus* Germ.
Narrow; head oblong; antennæ strongly elbowed, apical joints incurved; face spined. Hahn, W. I. t. 28.

PLOIARIA *Scop.* Gerris *Burm.* 3 sp. *Cim. vagabundus* De G.
Fore legs very short; coxæ elongated; four hind legs exceedingly long and slender. De G. Mém. tom. iii. pl. 17. f. 1.

NABIS *Latr.* { Nabis and Aptus *Hahn.* / Reduviolus *Kirby.* } 6 sp. *M. vagans* Fab.
Anterior tibiæ with an apical cushion; proboscis slender, extending to hind legs. Hahn, W. I. t. 6.

Family 5. (or 7.) *CIMICIDÆ* Westw. (Cimicidæ p. *Leach.* Membranacei p. *Latr., Burm.*)

CIMEX *Linn.* Acanthia *Fabr.* 4 sp. *C. lectularius* L. Curtis, 569.
Abdomen nearly circular; wing-covers very short, scaly; wings wanting. (My fig. 121. 1.)

Family 6. (or 8.) *TINGIDÆ* Westw. (Phymatites, Tingidites, and Cimicites p. *Lap.* Membranacei p. *Latr., Burm.*)

ANEURUS *Curt.* Aradus p. *Fab.* 1 sp. *A. lævis* Fall. Curtis, 86.
Antennæ with the terminal joint longest; tarsi 2-jointed; hemelytra veinless.

ARADUS *Fab.* Cimex p. *Linn.* 3 sp. *C. depressus* Fab. Curtis, 230.
Antennæ with the second joint longest; tarsi 2-jointed; hemelytra not covering the abdomen, strongly veined; scutellum distinct.

TINGIS *Fab.* Catoplatus *Spin.* 12 sp. *C. Cardui* Linn. Curtis, 741.
Ovate, depressed; antennæ naked, with the third joint longest; prothorax scarcely dilated at the sides, extending triangularly behind, like a scutellum, with three elevated lines.

PIESMA *St. F. & Serv.* { Aspidotoma *Curt.* / Zosmerus *Lap. & Burm.* } 2 sp. *A. capitata* Wolff.
Thorax subquadrate, not carinated nor hooded; front of head with two short convergent horns; scutellum distinct, hemelytra with distinct apical membranes. Wolff, Icon. C. f. 125.

AGRAMMA *Westw.* { Piesma *Lap.* nec Enc. M. / Serenthia *Spinola.* } 1 sp. *A. læta* Fall.

Narrow; antennæ short; thorax not dilated at the sides, nor 3-carinate; hemelytra homogeneous; legs short.

MONANTHIA *Enc. M.* Tingis p. *Lap.* 1 sp. *T. clavicornis* Linn.
Sides of prothorax scarcely dilated; antennæ pilose, last joint clavate. Pz. 23. 23.

GALEATUS *Curt.* Tingis p. *Burm.* 4 sp. *T. cristata.* Pz. 99. 19.
Prothorax much dilated at the sides, with a large hood in front; antennæ long, slender, pilose; areolæ of the thorax and hemelytra very large.

DICTYONOTA *Curt.* Tingis p. *Burm.* 2 sp. *T. Eryngii* Latr. Curt. 154.
Sides of thorax dilated, and areolate; the antennæ scabrous; terminal joint thinner than the third; prothorax with a frontal hood.

ACALYPTA *Westw.* Tingis p. *Panz.* 1 sp. *T. carinata* Pz. My fig. 120. 12.
Prothorax with the sides slightly dilated, 3-carinated; antennæ long, clavate, hemelytra meeting in a straight suture; wings wanting.

Family 7. (or 9.) *CAPSIDÆ* Westw. (Capsini *Burm.* Coreidæ p. *Steph.* Astemmites p. *Lap.*)

HETEROTOMA *Latr.* Capsus p. *Fab.* 2 sp. *H. spissicornis* Fab.
Narrow, smooth; antennæ with the second joint very thick and setose throughout its whole length. Pz. 2. 16.

CAPSUS *Fab.* Lygæus p. *Wolff.* 4 sp. *C. ater* Linn. My fig. 121. 5.
Broadly ovate, punctured; antennæ with the second joint longest, clavate at tip; wings and hemelytra perfect; neck moderate or narrow.

CHLAMYDATUS *Curt.* Capsus p. *Hahn.* 1 sp. *C. marginatus* Curt.
Subovate; head rather large, trigonate; antennæ with second joint longest; thorax semiorbicular; hemelytra small, ovate; hind legs long; thighs thickened. Curt. B. E. 693.

ASTEMMA *Latr.* nec Enc. Méth. { Orthonotus *Westw.*, Halticus *Hahn.* / Eurycephala *Lap.* olim, Bryocoris *Fall.* }
3 sp. *O. rufifrons* Fall. Hahn, f. 61.
Hemelytra uniting in a straight suture, without any apical membrane; thorax transverse, quadrate; antennæ long, slender; basal joint short; head as broad as the thorax; hind legs very long, slender.

LOPUS *Hahn.* Phytocoris p. *Burm.* 7 sp. *L. triguttatus* L. Hahn, f. 4.
Elongate-ovate; sides of the thorax acute, elevated, margined; head broader than long; eyes prominent; antennæ with the second joint not strongly clavate at the tip.

PILOPHORUS *Hahn.* Globiceps *Enc. M.* 1 sp. *bifasciatus* F.? *clavatus* L.?
Narrow; head broader than front of thorax, which is broadest behind; legs moderately long; antennæ with the two terminal joints short. Hahn, Icon. 1. 23.

ATTUS *Hahn.* Phytocoris p. *Fall.* 1 sp. *A. pulicaria* Fall. Hahn. f. 62.
Broadly ovate, thick, pulverose; antennæ moderately long, second joint longest, third and fourth together as long as the second; wing-covers entire; hind legs not thickened.

HARPOCERA *Curt.* Azinecera *Steph.* 1 sp. *H. Burmeisteri.* Curt. 709.
Narrow-ovate; antennæ with the second joint much shorter than the third, obliquely clavate at tip in ♂.

PANTILIUS *Curt.* Lopus p. *H. Sch.* 1 sp. *C. tunicatus* Fab.
Elliptic, depressed; head small, subtrigonate; antennæ almost as long as the body, third joint not so long as first; fourth shortest; hind tibiæ smooth, tarsi very short.

LYGUS *Hahn.* CIMEX p. *Linn.* 40 sp. *C. Coryli* Linn. Hahn, 18. 23.
Oblong-ovate, shining, finely punctured; thorax rounded in front; head much narrower than the thorax; antennæ with the third joint long and slender.

(POLYMERUS *Hahn* differs in having the sides of the thorax straight and legs thick).

CYLLECORIS *Hahn.* ——— — sp. *C. agilis* Wolff. Hahn, f. 182.
Narrow; thorax strangulated in front; antennæ and legs slender; head as broad as the front of the thorax.

PHYTOCORIS *Fall.* CIMEX p. *Linn.* 12 sp. *C. Populi* L. Wolff, 149.
Antennæ slender, with the first joint as long as the head and thorax, the latter not margined; head broader than long; hind legs very long.

MIRIS *Fab.* STENODEMA *Lap.* 12 sp. *C. dolabratus* Linn. Curtis, 701.
Elongate, narrow; antennæ very long, basal joint thickest, porrected, second joint longest, slender; ocelli 0.

Family 8. (or 10.) *LYGÆIDÆ* Westw. (Coreidæ p. *Leach, Steph.* Lygæodes *Burm.* Lygæites and Astemmites p. *Lap.*)

LYGÆUS *Fab.* CIMEX p. *Linn.* 1 sp. *C. equestris* Linn. Curtis, 481.
Oblong; wings perfect; ocelli two; legs all slender; last joint of antennæ subfusiform.

HETEROGASTER *Schill.* LYGÆUS *Fab.* 4 sp. *C. Urticæ* F. Curtis, 597.
Antennæ with the basal joint shorter, fourth longest, slightly clavate; eyes prominent; ocelli two; ovipositor arising from the centre of the abdomen; legs of equal thickness.

PYRRHOCORIS *Fall.* { PLATYNOTUS *Schill.* / MEGANOTUS *Lap.* } 1 sp. *C. apterus* Linn.
Obovate; thorax broad, slightly narrowed across the middle; ocelli wanting; antennæ with the first and fourth joints of nearly equal length, second the longest; wings often obsolete. Curtis, 465. (My fig. 121, g.)

RHYPAROCHROMUS *Hahn.* { APHANUS *Lap.*, PACHYMERUS *St. F. & Serv.* / PACHYBRACHIUS *Hahn*, PLINTHISUS *Westw.* / POLYACANTHUS *Lap.*, MICROTOMA *Lap.* olim. } 25 sp.
C. Echii F. Curtis, 612.
Ocelli two, fore thighs thickened, toothed; first joint of antennæ shorter, fourth longest.

Obs. The species, which are very numerous, differ in the form of the thorax: Pachybrachius *Hahn* (Icon. Cimic.) has it constricted in the middle; in Plinthisus *Westw.* (*P. brevipennis* Latr.) it is nearly square, without any transverse impression. H. Schäffer retains Pachymerus (previously employed in Coleoptera) for *P. Echii, Pini*, &c., and Aphanus (*P. sabulosus* Fall.). Burmeister reunites them with the next into a single genus.

GASTRODES *Westw.* PLATYGASTER *Schill.* 1 sp. *C. Abietis* Linn.
Fore femora thickened, toothed; females with the last two abdominal segments cleft in the middle; abdomen flattened; thorax dilated behind. Pz. 92. 22.

ANTHOCORIS *Fall.* { RHYNARIUS *Hahn*, PEDETICUS *Lap.* / HYLOPHILA *Kirby*, LYGÆUS *Fab.* } 6 sp. *C. Nemorum* L.
Face rostrated; apical membrane of elytra veinless; stigma very large; first and second joint of proboscis very short, third very long, fourth short; ocelli two. Hahn, f. 58.

XYLOCORIS *Dufour.* ——— 1 sp. *X. ater* L. D.
Differs from Anthocoris only in the two basal joints of the antennæ being rather longer, and the terminal joint of the antennæ slenderer; the hemelytra are sometimes imperfect. Ann. Soc. Ent. Fr. vol. ii. pl. 6. B. f. 3.

MICROPHYSA *Westw.* Loricula *Curt.* 2 sp. *L. Pselaphoides* Burm.
Very broad; abdomen nearly round; head advanced in front; three terminal joints of antennæ nearly equal, second joint of proboscis longest; legs slender; hemelytra coleoptrated, short. Westw. in Ann. Soc. Ent. Fr. vol. iii. pl. 6. f. 3.

Family 9. (or 11.) *COREIDÆ* Westw. (Coreidæ p. *Leach, Steph.* Coreodes *Burm.* Anisoscelites and Coreites *Lap.*)

COREUS *Fab.* Syromastes *Latr.* 3 sp. Typ. verus, *C. marginatus* L. Curt. 174.
Antennæ with the basal joint flattened, second and third longer, slender, nearly equal, fourth shorter, clavate; sides of thorax not dilated.

MEROCORIS *Hahn.* Coreus *Latr.* 3 sp. *C. denticulatus* Scop. My fig. 121. 11.
Antennæ with all the joints compressed; first large, subarcuate; the three last nearly equal in length and thickness; sides of thorax often dilated.

ARENOCORIS *Hahn.* { Atractus *Lap., Curt.* / Pseudophlœus *Burm.* } 1 sp. *A. literatus* Curt. Curtis, 500.
Obovate, depressed; basal joint of antennæ flattened, second and third slender, third longest, fourth short, thick (*fig.* 121. 15.); sides of thorax not dilated.

CHOROSOMA *Curt.* { Rhopalus fam. 2. *Schill.* / Myrmus *Hahn.* } 2 sp. { *Rh. Schillingii* Schum. / (*Ch. Arundinis* Curtis.)
Linear; antennæ moderate, not elbowed, second joint longest; legs moderately long. Curtis, 297.

STENOCEPHALUS *Latr.* Dicranocephalus *Hahn, Icon.* 1 sp. *L. nugax* Fab.
Elongate-ovate; antennæ with the first joint thickest, second and fourth equal, fourth not thicker than the preceding. Donov. pl. 218. f. 1.

ALYDUS *Fabr.* Lygæus *Fab.* 1 sp. *C. calcaratus* Linn. Curtis, 369.
Narrow; three basal joints of antennæ nearly equal, fourth longest and thickest; hind legs longest; femora spined.

NEIDES *Latr.* Berytus *Fab.* 3 sp. *Cim. tipularius* L. Curtis, 150.
Linear; antennæ very long, elbowed, basal joint longest, second very short; legs very long.

CORIZUS *Fallen.* Lygæus p. *Fab.* 1 sp. *C. Hyosciami* L. Curtis, 481.
Head rhomboidal, narrowed behind; eyes small, prominent; basal joint of antennæ shortest, terminal joint stoutest, subfusiform; elytra ample; legs simple.

RHOPALUS *Schill.* fam. 1. Corizus p. *Burm.* 3 sp. *C. capitatus* Wolff, f. 72.
Differs from Corizus in the hemelytra being submembranaceous, diaphanous with thick nerves, forming a quadrate cell; seventh ventral segment covered by the sixth.

CYMUS *Hahn.* { Kleidocerys *Westw.* / Heterogaster, fam. 3. *Schill.* } 3 sp. *Lyg. Resedæ* Pz. 40. 20.
Hemelytra covering the abdomen, with the outer margin depressed; apical membrane with slight separate nerves inflexed at the base; terminal joint of antennæ clavate.

Family 10. (or 12.) *SCUTELLERIDÆ* Westw. (Scutati *Burm.* Pentatomidæ *Leach, Steph.* Pentatomites and Scutellerites *Lap.*)

Subfamily 1. *Pentatomides.*

ÆLIA *Fab.* Cimex p. *Burm.* 1 sp. *Æ. acuminata* F. Curtis, 704.

Head elongate-trigonate; legs smooth; tarsi 3-jointed; scutellum not covering the abdomen; first and second joints of antennæ very short, subequal.

ACANTHOSOMA *Curt.* CLINOCORIS *Hahn.* 4 sp. *C. hæmorrhoidalis* L. Curt. 28.
Scutellum not covering the abdomen; tarsi 2-jointed; antennæ with joints nearly equal, third rather shortest; pro- and meta-sternum keeled. (My fig. 121.17.)

RAPHIGASTER *Lap.* PENTATOMA p. *Curt.* 20. 1 sp. *C. punctipennis* Illig., *grisea* F.
Metasternum with a long porrected spine; antennæ with the first joint shortest, third shorter than second. Pz. 33. 19.

EURYDEMA *Lap.* STRACHIA *Hahn.* 4 sp. *C. oleracea* Linn. Pz. 32. 12.
Broadly ovate; head broad; eyes transverse; legs long; antennæ long, basal joint oval, second longest.

PENTATOMA *Latr.* CIMEX and ASOPUS *Burm.* 15 sp. *C. rufipes* Linn.
Subelongate-ovate; head oblong; legs smooth; tarsi 3-jointed; scutellum not covering the abdomen; eyes slightly prominent. (My fig. 122. 1.)

Obs. Hahn has separated several genera from this; viz. Eysarcoris (*P. perlata, punctata*), Ialla (*P. dumosa*), Arma (*P. lurida, custos, bidens*), and Tropicoris (*P. rufipes*).

CYDNUS *Fab.* CIMEX p. *Linn.* 6 sp. *C. bicolor* L. Curtis, 74.
Orbicular, ovate, depressed; legs very spinose; two basal joints of antennæ very short, three last nearly equal.

SCIOCORIS *Fallen.* CYDNUS p. *Fabr.* 1 sp. *Cim. umbrinus* Pz. 93. 15.
Depressed, acutely margined; head large; second joint of proboscis long; legs pilose; sides of abdomen exposed; scutellum moderate.

Subfamily 2. *Scutellerides.*

COPTOSOMA *Lap.* THYREOCORIS *Leach.* 1 sp. *C. globus* Fab. Wolff, fig. 3.
Scutellum very broad behind, emarginate in ♂; second joint of antennæ very short.

ODONTOSCELIS *Lap.* THYREOCORIS *Hahn.* 1 sp. *C. scarabæoides* Linn.
Legs very spinose; antennæ inserted under the eyes, third joint twice as long as the second. Wolff, f. 4.

URTOCORIS *Hahn.* ODONTOSCELIS p. *Burm.* 2 sp. *C. fuliginosa* Linn.
Legs very spinose; antennæ inserted under the eyes, second joint of antennæ longer than third. Curt. 685.

PODOPS *Lap.* TETYRA p. *Steph.* 1 sp. *C. inuncta* Pz. 36. 24.
Prothorax appendiculated on each side in front; second joint of antennæ shorter than third; legs almost smooth.

BELLOCORIS *Hahn.* EURYGASTER *Lap.* 2 sp. *C. maura* Linn. Hahn, f. 139.
Legs slightly spinose; second and third joints of antennæ of equal length.

[GRAPHOSOMA *Lap.* TRIGONOSOMA p. *Burm.* 1 sp. *C. lineata* L. Wff. f. 1.]

ORDER XII. APHANIPTERA *Kirby.* (SUCTORIA *De Geer.* SIPHONAPTERA *Latr.* ROPHOTEIRA *Clairv.* APTERA *MacL., Lam.*)

Family *PULICIDÆ.*

PULEX *Linn.* ——— 17 sp. *P. irritans* L. My fig. 114. 1.
Labium developed, with articulated labial palpi.

Obs. Ceratopsyllus *Curt.* (Ceratophyllus *Curt. B. E.*) consists of species in the type of which the antennæ are "inserted on each side of the crown

of the head, concealed in a cavity behind the eyes when at rest, and as long as the head, 4-jointed;" but other species introduced into the genus are described by Curtis as differing entirely in this respect; hence the character, derived from the antennæ, appears to me to be merely specific. Some of the species, however (*P.* vespertilionis and elongatus), being of a much more slender general form, I have proposed for them the generic name of Ischnopsyllus (*Ent. Mag.* No. 4.).

Order XIII. DIPTERA *Aristotle.* (Antliata *Fabricius.* Halteriptera *Clairv.*)

Sect. I. Cephalota *Westw.* (See Vol. II. pp. 505. and 506.)

Division 1. (Stirps 1.) *Nemocera* Latr., MacL. (Tipulariæ *Meig.*)

Fam. 1. *CULICIDÆ* Leach. Culicides *Macq.* H. N. Dipt.

CULEX *Linn.* ——— 20 sp. *C. pipiens* Meig. Curtis, 537.
Palpi longer than the proboscis ♂, very short ♀.

ANOPHELES *Meig.* Culex p. *Linn.* 3 sp. *Cul. bifurcatus* Linn. Curt. 210.
Palpi of equal length with the proboscis in both sexes.

ÆDES *Hoff., Meig.* ——— 1 sp. *Æd. cinereus?* Hoff. Meig. Abb. 3. f. 1.
Palpi very short ♂, pointed and thick at the base ♀.

Family 2. *TIPULIDÆ* Leach. (Tipulides *Macq.* H. N. Dipt.)

Subfamily 1. *Chironomides* Westw. (*Culiciformes* Latr., Macq.)

CORETHRA *Meig.* Chironomus p. *Fab.* 3 sp. *Ch. plumicornis* Fab.
Antennæ ♂ plumose to the tip; legs placed at equal distances apart; sternum not prominent. Steph. pl. 42. f. 1.

CHIRONOMUS* *Meig.* Tipula p. *Linn.* 91 sp. *C. plumosus* L. Curtis, 90.
Four hind legs at a distance from the others; sternum prominent; last joint of ♂ antennæ longest. (My fig. 124. 8.)

TANYPUS *Meig.* Chironomus p. *Fab.* 26 sp. *T. monilis* Linn. Curtis, 501.
Antennæ 14-jointed in both sexes, penultimate joint longest; sternum prominent; four hind-legs wide apart.

SPHÆROMIAS *Steph.* ——— 6 sp. *Sph. albomarginatus.* Curtis, 285.
Antennæ slender, basal joint globular, eight following joints short, five terminal joints long; eyes emarginate; trophi fully developed.

CERATOPOGON *Meig.* Chironomus p. *Fabr.* 18 sp. *C. Stigma* Meig.
Antennæ ♂ plumose at the base, 5 terminal joints elongated, simple in ♀; all the femora simple; second joint of palpi longest; legs of nearly equal length; two submarginal cells. Meig. Zw. 1. pl. 2. f. 18.

PALPOMYIA *Meig.?, Steph.* Ceratopogon *B. Meig.* 10 sp. *C. spinipes* Meig.
Differs from Ceratopogon in having the fore thighs thick and spinose beneath. Pz. 103. 14.

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* Our lakes and greater rivers yield a species remarkable for its wings incumbent, as in Ceratopogon; but with the other characters of the genus, *Ch. lacustris*, difute prasinus thorace vittis 3 ferrugineis; tibiis anticis subfuscis (alis nudis; halteribus albidis). Long 2 lin. ♂ — 1¼ ♀. (*Haliday MSS.*)

PRIONOMYIA *St.* { SERROMYIA *Meig.?* / CERATOPOGON C. *Meig.* } 6 sp. *Cerat. femorata* F. Meig. Kl. pl. 2. f. 4.

Differs from Ceratopogon in having the hind thighs thickened.

CULICOIDES *Latr.* CERATOPOGON p. *Meig.* 6 sp. *C. pulicaris* Linn.

Femora simple, not spined; one large imperfect submarginal cell. Meig. Zw. 1. pl. 2. f. 17.

(LABIDOMYIA *St.* FORCIPOMYIA *Meig.?* 2 sp. *Cer. bipunctata* Linn. Meig.)

ORPHNEPHILA *Hal.* CHENESIA *Macq.* 1 sp. *O. devia* Hal.

Eyes confluent in front; ocelli 0; antennæ very short, naked in both sexes; base globose; anterior tarsi elongated; wings incumbent, parallel. Zool. Journ. vol. v. pl. 15. f. 2.

Subfamily 2. *Cecidomyides* Westw. (Gallicoles *Latr.*, *Macq.*)

DIOMYZA *Meg.* LASIOPTERA A. *Meig.* 3 sp. *D. fuliginosa* Steph.

Wings with the costa thickened; one longitudinal and furcate nerve; tarsi very long; basal joint short; antennæ short, joints not verticillate, Steph. pl. 42. f. 4.

LASIOPTERYX *Steph.* LASIOPTERA B. *Meig.* 5 sp. *Las. obfuscata* Meig.

Differs from Diomyza in having the basal joint of the tarsi elongate.

CECIDOMYIA *Latr.* OLIGOTROPHUS *Latr.* olim. 28 sp. *Tip. Tritici* K.

Legs very long; basal joint of tarsi very minute; antennæ long, especially in ♂; joints verticillate; wings with two longitudinal, and one inner furcate nerve. My fig. 125. 3.

PLANETELLA *Westw.* PLANETES *Wlk.* (G. *Carab.*) 1 sp. *Pl. extremus* Wlk.

Antennæ ♀ 12-jointed, half the length of the body, joints long, equal; twelfth conic, acuminate; thorax produced over the head; legs thick, basal joint of tarsi very short.

CAMPYLOMYZA *Wied.* CECIDOMYIA *Meig.* olim. 4 sp. *C. flavipes* Meig.

Antennæ short, not verticillate, 14-jointed; subcostal nerve furcate at tip, and two longitudinal furcate discoidal nerves. Meig. Zw. 1. pl. 3. f. 6.

PSYCHODA *Latr.* TINEARIA *Schill.* 10 sp. *T. Phalænoides* Linn. Curt. 745.

Wings deflexed at the sides of the body with numerous nervures; antennæ verticillated, 14—15-jointed.

(*S. G.* A. Saccopteryx *Hal.*, *P. fuliginosa* Meig., B. Psychoda, *P. ocellaris Meig.* (my fig. 125. 9.), C. Trichomyia *Hal.*, *P. urbica*, and D. Sycorax *Hal.*, *P. silacea* Hal. See *Curtis.*)

ZYGONEURA *Meig.?* ——— 1 sp. *Z. sciarina* Wint. Meig. Zw. 6. t. 65. f. 15.

Antennæ long, 14-jointed, verticillate; legs long, slender; first longitudinal discoidal nerve furcate; upper branch of fork much curved.

MOLOBRUS *Latr.** SCIARA *Meig.* 28 sp. *Tip. Thomæ* Linn.

Antennæ short, 16-jointed, filiform pilose; eyes reniform; first longitudinal discoidal nerve furcate; branches of fork nearly straight. Meig. Zw. 1. pl. 4. f. 3.

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* " Chionea venatica *Curt. Guid.* 1164[b]. 1. The insect I had here indicated is a small apterous Molobrus, allied to M. longipes, but with *wings and poisers quite absent;* the terminal spurs of tibiæ obsolete: the thorax much compressed behind, so as to seem conical from above; the abdomen incrassate in the middle, the attenuate extremity decurved and furnished with the ordinary two linear obtuse pubescent and free valves of ovipositor. I should not have hesitated to identify this with De Geer's *Tipula atomaria*, if the latter had not been represented as hairy.

LESTREMIA *Macq., Meig.* DIAMESA *Meig.* 3*sp. *L. leucophæa* M.
Antennæ 15-jointed, joints globular, pedicellate ♂, cylindric ♀; legs long; wings with a marginal cell divided by a transverse nerve. Meig. pl. 65. f. 16.

ANARETE *Hal.* ——— 1 sp. *A. candidata* Hal. *Pini* D. G. ?
Antennæ short, 9-jointed; eyes emarginate; ocelli three; eyes incumbent, naked; a furcate nerve inserted in the middle of the costa; tibiæ not spurred.

CATOCHA *Hal.* ——— 1 sp. *C. latipes* Hal.
Antennæ porrected; two basal joints thick, ♂ 16-jointed; joints globular, pilose; antennæ 10-jointed; ocelli three; furcate nerve inserted near the base of the costa.

Subfamily 3. *Mycetophilides* Westw. (Fungicolæ *Meig., Macq.* Fungivores *Latr.*)

RHYPHUS *Latr.* ANISOPS *Meig.*, olim. 4 sp. *T. fenestralis* Scop. Curt. 102.
Antennæ short, 14-jointed, cylindrical; wings with a central oblong cell; second joint of palpi swollen; legs not spinose. (My fig. 125. 16.)

CORDYLA *Meg.* ODONTOPHILA *Meg.* 4 sp. *C. fusca* Latr. Macq. pl. 3. f. 17.
Body compressed; antennæ short, 14-jointed, compressed; joints transverse; ocelli three, in a line; nerves of wings simple.

MYCETOBIA *Meig.* ——— 1 sp. *M. pallipes* Meg. Meg. pl. 8. f. 10.
Nervures simple; antennæ with cup-shaped joints, much shorter than the body; terminal joint of palpi elongated; ocelli three, in a triangle.

PLATYURA *Meig.* SCIARA p. *Fab.* 13 sp. *Sc. lineata* Fab. Curt. 134.
Antennæ short, with transverse joints; first longitudinal nerve with an oblique nervure at the apex; palpi with oblong joints; body generally depressed.

SCIOPHILA *Hoffm.* PLATYURA p. *F.* 17 sp. *fimbriata* Meig. Curt. 641.
Ocelli apart, middle one small; wings with a small subquadrate cell between the subcostal and longitudinal nerves; antennæ short.

LEIA *Meig.* ——— 12 sp. *L. nitidicollis* M. Curt. 645.
Ocelli three, distant, central one small; wings without a subquadrate cell; antennæ as long as the thorax, with cup-shaped joints; palpi long.

MYCETOPHILA *Meig.* SCIARA p. *Fab.* 47 sp. *Sc. lunata* Fab.
Ocelli two or 0; wings without a subquadrate cell; trophi short; antennæ rather short. My fig. 125. 11.

LEPTOMORPHUS *Curt.* ——— 2 sp. *L. Walkeri* Curt. BE. 365.
Antennæ with oblong joints; terminal joint of palpi elongated; ocelli three, central one very minute; posterior tibiæ not externally spined.

MACROCERA *Meig.* ——— 9 sp. *M. phalerata* Hoff. Curt. 637.
Antennæ much longer than the body; second subcostal nervure continued to the apex; ocelli three, close together.

BOLETOPHILA *Hoffm.* MESSALA *Curt.* ♂ 3 sp. *B. cinerea* Hoff. Ste. 44. f. 1.
Antennæ nearly as long as the body; second subcostal nervure terminated abruptly; ocelli, three in a line. Curt. 581.

As Chionea appears to be one of the *Tericolæ*, I was clearly in error in supposing any connection with that genus." (*Haliday MSS.*)

* "I find 3 sp. The ♂ antennæ are as *Chironomus*, so that the additional transverse nervure is the only generic character, the eyes being reniform in the commonest species, which I take for *Ch. obscurimanus*; even in *D. Walkii*, they are slightly notched. A third species has an additional joint in antennæ ♀." (*Haliday MSS.*)

Subfamily 4. *Tipulides* Westw. (Rostratæ *Meig.* Tericoles *Latr.*, *Macq.*)

TRICHOCERA *Meig.* TIPULA p. *D. G.* 6 sp. *Tip. hiemalis* De G.[1]
Antennæ with the terminal joints exceedingly slender and indistinct; legs very long and slender; palpi with five nearly equal-sized joints; wings with five posterior cells. Meig. Zw. 1. pl. 7. f. 9.

DIXA *Meig.* ——— 9 sp. *D. aprilina* Meig. Curt. 409.
Wings with the first and third apical nervures furcate; antennæ very slender; thorax projecting; ocelli 0.

PERONECERA *Curtis.* ——— 2 sp. *P. fuscipennis* Curt. BE. 589.
Antennæ not so long as the thorax, in the male 7-jointed, last joint small; shorter, and 8-jointed in female, fifth short, three following forming a mass; wings with three submarginal cells.

NEMATOCERA *Meig.* ANISOMERA *St. Cat.* 1 sp. *nigra* Latr.
Antennæ much longer than the thorax, slender, 6-jointed, four terminal joints long; palpi with a short terminal joint.

PTYCHOPTERA *Meig.* TIPULA p. *Linn.* 5 sp. *T. contaminata* Linn.
Palpi with the last joint very long; antennæ filiform, 16-jointed, third joint long; wings folded at the anal nerve; discoidal cell wanting. Meig. Zw. 1. pl. 6. f. 17.

NEPHROTOMA *Meig.* TIPULA p. *Fab.* 1 sp. *T. dorsalis* F.
Last joint of palpi elongate; antennæ ♂ 19-jointed, fourth and following joints kidney-shaped. Meig. Zw. 1. pl. 5. f. 19–22.

DOLICHOPEZA *Curt.* LEPTINA *Meig.* pl. 1 sp. *D. Sylvicola* Curt. 62.
Antennæ 12-jointed, slender, simple; legs very long; ocelli 0; terminal joint of palpi long; third discoidal cell wanting.

PACHYRHINA *Macq.* TIPULA p. *Steph.* 8 sp. *Tip. crocata* L. Donov. pl. 48. f. 1.
Differs from Tipula in second posterior cell sessile, nasus thicker, and first joint of antennæ shorter.

√ TIPULA *Linn.* LIMONIA *Meig.* olim. 36 sp. *T. gigantea* F. Curt. 493.
Antennæ simple, 13-jointed, with whorls of hair; last joint of palpi moderately long; wings with seven apical cells.

√ CTENOPHORA *Meig.* XIPHURA & DICTENIDIA *Br.* 8 sp. *Tip. pectinicornis* L.
Antennæ 13-jointed, pectinated in ♂; last joint of palpi elongate. Curt. 5.

PEDICIA *Latr.* LIMNOBIA p. *Meig.* 1 sp. *Tip. rivosa* Linn. K. & S. pl. 4. f. 4.
Fourth joint of the palpi long and flexible; antennæ 16-jointed, third and sixth joints subglobose, seven terminal ones slender; second posterior cell petiolated.

SYMPLECTA *Meig.* HELOBIA *Enc. Méth.* 5 sp. *L. punctipennis* M.
Wings with seven apical cells; anal nerve greatly bent; palpi short, with nearly equal joints; eyes united in front; antennæ filiform, 16-jointed. Macq. pl. 2. f. 11.

? GLOCHINA *Meig.* ? { SIAGONA *Meig.* in pl. / LIMNOBIA p. *Macq.* } 2 sp. *G. leucocephala* Hal. Meig. pl. 65. f. 5.
Antennæ 14-jointed; trophi greatly elongated; palpi long, 5-jointed.

√ LIMNOPHILA *Macq.* LIMNOBIA p. *Meig.* 10? sp. *L. pictipennis* Meig.
Joints of palpi of equal length; antennæ filiform, ordinarily 16-jointed; third and following joints globular; wings incumbent; five posterior cells. Macq. tab. 2. f. 5.

CYLINDROTOMA *Macq.* LIMNOBIA p. *Meig.* 8? sp. *distinctissima* Macq. t. 2. f. 9.
Joints of the palpi nearly equal; antennæ filiform, 13-jointed, cylindric; wings incumbent; two submarginal cells, four or five posterior.

LIMNOBIA *Meig.* Limonia *Latr.* 28 sp. *T. 3-punctata* F. Macq. t. 2. f. 7
Antennæ 15—17-jointed, filiform, terminal joints oblong; palpi with the terminal joint short; wings incumbent; four posterior cells.

Obs. L. tenella, the type of *Gonomyia* Hgg., and L. lutea, modesta, &c., placed by Stephens in his G. *Dicranomyia*, are united by Macquart to Limnobia.

IDIOPTERA *Macq.* ——— 1 sp. *I. pulchella* Macq. pl. 2. f. 3, 4.
Nasus very short; antennæ half as long as the body, with oblong joints; basal internal cell of wings divided by a transverse nerve.

ULA *Hal.* ——— 1 sp. *Ul. mollissima* Hal.
Antennæ porrected, 17-jointed; two basal joints short, thick, the remainder oblong, subequal; palpi incurved, 4-jointed, last joint long; wings incumbent, pubescent.

GERANOMYIA *Hal.* ——— 2 sp. *C. unicolor* Hal. Curtis, 573.
Antennæ 14-jointed; trophi greatly elongated; palpi very short, 2-jointed.

RHAMPHIDIA *Meig.* Leptorhina *Steph. Cat.* 1 sp. *Rh. longirostris* Wied.
Antennæ 16-jointed; clypeus greatly elongated; trophi small; palpi 4-jointed, last joint long; wings with four posterior cells.

RHIPIDIA *Meig.* ——— 2 sp. *R. maculata* Meig. Zw. 1. t. 5. f. 11.
Palpi with short subequal joints; antennæ 14-jointed, fourth, and following, globose, apart, and bipectinate in ♂; four posterior cells.

ERIOPTERA *Meig.* Eriopteryx *Steph.* 30 sp. *T. flavescens* L. Curtis, 557.
Wings rather long; veins hairy; legs rather stout; antennæ 16-jointed, joints oblong verticillate ♂; joints of palpi equal.

MOLOPHILUS *Curt.* Eriopteba p. *Meig.* 1 sp. *Er. atra* Meig. Curt. 444.
Wings very short, hairy; abdomen of males terminated by two large lobes; antennæ short, moniliform, 17-jointed; legs very long.

Subfamily 5. *Bibionides* Westw. (Muscæformes *Meig.* Florales *Latr.*, *Macq.*)

SIMULIUM *Latr.* Atractocera *Meig.*, *Kl.* 13 sp. *C. reptans* Linn. Curt. 765.
Fourth joint of palpi slightly elongate; antennæ 11-jointed; ocelli 0; basal joint of tarsi very large; wings large.

SCATHOPSE *Geoffr.* Ceria *Scop.* 8 sp. *T. notata* Linn. Meig. Z. 1. pl. 10. f. 13.
Palpi hidden, 1-jointed; antennæ cylindric, 11-jointed; eyes reniform; second posterior cell petiolated.

DILOPHUS *Meig.* Bibio p. *Oliv.* 5 sp. *T. febrilis* Linn. Meig. Zw. pl. 11. f. 1.
Antennæ 11-jointed, four terminal joints united in a mass; fore tibiæ terminated by eight points; tarsi 3-pulvillose, no discoidal cell.

BIBIO *Geoffr.* Hirtea p. *Fab.* 19 sp. *Tip. Marci* Linn. Curt. 138.
Antennæ 9-jointed, cylindric, perfoliated; eyes ♂ occupying nearly all the head; fore thighs thickened; fore tibiæ terminated by a long spine.

ASPISTES *Hoffm.* ——— 1 sp. *A. Haworthii* Curt.
Antennæ 8-jointed, last joint very large, oval; one basal cell emitting three long oblique nerves. Meig. Zw. 1. tab. 11. f. 16.

Division 2. *Brachocera* Macquart.

Stirps 1. *Notacantha* Latr.

Family 1. (or 3.) *STRATIOMIDÆ* Westw. (Stratiomydes *Latr.*)

PACHYGASTER *Meig.* Vappo *Latr.* 2 sp. *V. ater* Fab. Curt. 42.
Third joint of antennæ large, subhemispherical, subarticulated, with a dorsal arista; abdomen globose; scutellum unarmed; discoidal cell large.

SARGUS *Latr.* Nemotelus p. *D.G.* 5 sp. *M. cuprarius* L. Curt. 305.
Palpi indistinct, replaced by two points; antennæ with the third joint scarcely larger than the second, and apparently composed of several joints united together with a subterminal seta; scutellum not spined; abdomen elongate-ovate.

CHRYSOMYIA *Macq.* Chloromyia *Dunc.* 4 sp. *M. politus* L. Donov. pl. 142. f. 1.
Differs from Sargus in the eyes of the ♂ united, and the proboscis with short palpi.

NEMOTELUS *Fab.* Musca p. *Linn.* 4 sp. *M. pantherinus* L. Curt. 729.
Third and three following joints forming an ovate-conic mass, with a terminal biarticulate style; labium greatly elongated.

CLITELLARIA *Meig.* Ephippium *Latr.* 1 sp. *C. Ephippium* F. Steph. pl. 46. f. 1.
Third and four following joints of the antennæ forming a subulated mass, with a terminal biarticulate style; eyes villose; abdomen very broad.

OXYCERA *Meig.* Musca p. *Linn.* 9 sp. *M. trilineata* L. Curt. 441.
Third and three following joints of antennæ forming an oval mass, terminated by a style composed of two terminal joints; eyes ♂ villose; abdomen suborbicular.

STRATIOMYS *Geoffr.* Odontomyia p. *Sam.* 5 sp. *M. chamæleon* L.
Proboscis very short; basal joint of antennæ much longer than second; terminal joints forming a fusiform club, without a style; scutellum spined. My fig. 127. 1.

ODONTOMYIA *Meig.* Musca p. *Linn.* 8 sp. *M. Hydroleon* L. Pz. 58. 19.
Basal joint of antennæ shorter; proboscis slenderer; wings generally with four posterior cells.

Family 2. (or 4.) *BERIDÆ* Westw. (Decatoma p. *Latr.* Xylophagidæ *Steph.* Xylophagi p. *Meig.* Xylophagii *Macq.*)

SUBULA *Meig.* Xylophagus B. *Meig.* 1 sp. *S. maculata* F. My fig. 127. 12.
Scutellum unarmed; antennæ 10-jointed; eyes ♂ apart.

BERIS *Latr.* Stratiomys p. *Geoffr.* 11 sp. *M. clavipes* Linn. Curt. 337.
Scutellum 6- or 8-spined; antennæ 10-jointed; eyes contiguous ♂; palpi obsolete.

ACTINA *Meig.* Beris p. *Macq.* 1 sp. *A. tibialis* Meig. Steph. pl. 46. f. 2.
Scutellum 4-spined; palpi long; eyes apart in ♂.

Family 3. (or 6.) *CŒNOMYIDÆ* Westw. (Sicarii *Latr.*, *Macq.* Xylophagi p. *Meig.*)

XYLOPHAGUS *Meig.* A. Nemotelus *D.G.* 2 sp. *X. ater* Fab. My fig. 127. 16.
Antennæ 10-jointed, basal joint long; ovipositor of ♀ elongated; eyes distant ♂.

Stirps 3. *Tanystoma* Latr.

Family 1. (or 7.) *TABANIDÆ* Leach. (Tabanii *Latr.* Hexachætes *Mcq.*)

TABANUS *Linn.*, *&c.* ——— 21 sp. *T. bovinus* Linn. Curt. 78.
Antennæ 7-jointed, not longer than the head, third joint excised at base.

HÆMATOPOTA *Meig.* TABANUS p. *L.* 4 sp. *T. pluvialis* Linn. Curt. 525.
Antennæ 6-jointed, longer than the head, third joint thickened at base.

CHRYSOPS *Meig.* TABANUS p. *Linn.* 4 sp. *T. cæcutiens* Linn.
Ocelli distinct; antennæ long, 7-jointed. Donovi pl. 131.

Family 2. (or 8.) *BOMBYLIIDÆ* Leach. (Bombyliarii *Meig.*, *Latr.*)

BOMBYLIUS *Linn.*, *&c.* ——— 8 sp. *B. major* L. My fig. 128. 11.
Terminal wing-cells terminated by nerves, parallel with the posterior margin; basal joint of antennæ long.

PHTHIRIA *Latr.* [Ploas *St. Cat.*] *2 sp. *P. pulicaria* Mik. Curt. 521.
Terminal wing-cells extending to the hind margin; basal joint of antennæ short.

Family 3. (or 9.) *ANTHRACIDÆ* Leach. (Anthracii *Latr.* Bombyliarii p. *Latr.* Nemestrinidæ and Anthracii *Mcq.*)

LOMATIA *Meig.* STYGIA *Meig.* olim. 2 sp. *An. Belzebub* F. Pz. 45. 16.
Elongate; antennæ close together.

ANTHRAX *Fab.* NEMOTELUS p. *D. G.* 5 sp. *M. Hottentotta* L. Curt. 9.
Short; antennæ apart at the base.

Family 4. (or 10.) *ACROCERIDÆ* Leach. (Vesiculosa *Mcq.* Inflatæ *Meig.*, *Latr.*)

ACROCERA *Meig.* SYRPHUS p. *Pz.* 2 sp. *S. globulus.* Pz. 86. 20.
Antennæ setaceous at tip, inserted close to the ocelli.

HENOPS *Illig.* OGCODES *Latr.* 2 sp. *M. gibbosa* L. Curt. 110.
Antennæ subclavate, inserted close to the eyes.

Family 5. (or 11.) *EMPIDÆ* Leach. (Empidiæ *Meig.*)

EMPIS *Linn.* ——— 31 sp. *E. tessellata* F. My fig. 129. 2.
Proboscis much longer than the head; two submarginal cells.

(PACHYMERIA *St.* EMPIS B. p. *Meig.* 2 sp. *E. ruralis* Meig. Harr. Exp. pl. 44. f. 4.)

(PLATYPTERYGIA *St.* PLATYPTERA *Meig.* olim. 1 sp. *E. borealis* Linn. Curt. 18.)

RHAMPHOMYIA *Hoffm.* EMPIS p. *Fab.* 24 sp. *E. nigripes* Fab. Curt. 517.
Proboscis long; one submarginal cell.

(ENICOPTERYX *Steph.* RHAMPHOMYIA p. *Meig.* 3 sp. *Rh. infuscata* Meig. Zw. pl. 23. f. 4.)

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* The second species of this genus, now first recorded as a native insect, from the collection of Mr. Shuckard, is the Ph. fulva *Latr.* figured in the frontispiece to Vol. I. *fig.* 9.

HILARA *Meig.* Tachydromia p. *Fab.* 23 sp. *T. fuscipes* Fab. Curt. 130.
Proboscis shorter than the head; third joint of the antennæ elongate; style short.

BRACHYSTOMA *Meig.* Baccha p. *F.* 2 sp. *B. longicornis* Meig.
Proboscis shorter than the head; third joint of the antennæ elongate-conic; style very long. Meig. pl. 22. f. 8.

GLOMA *Meig.* ——— 1 sp. *G. fuscipennis.* Meig. pl. 22. f. 11.
Proboscis shorter than the head; third joint of antennæ globular.

Family 6. (or 12.) *Tachydromiidæ.* (Tachydromii *Meig.* Empides p. *Mcq.*)

HELEODROMIA* *Hal.* { Paramesia *Mcq.* / Hydrodromia *Mcq.* } 4 sp. *H. bistigma* Hal.
Legs simple; proboscis short, thick, somewhat exserted; wings with an oblique apical nervure; antennæ 3-jointed; seta 2 jointed. Curt. 513.

SCIODROMIA *Hal. MSS.* Heleodromia *Mcq.* 1 sp. *H. immaculata* Hal.
Differs from Heleodromia in the proboscis being perpendicular, longer than the head; palpi short, incumbent.

ARDOPTERA *Mcq.* { Leptoscelis *Hal.* / [Leptoscelis *Latr.* g. Hemipt.] } 3 sp. *H. irrorata* Fal.
Very narrow; eyes large; hypostoma linear; proboscis short, thick; palpi incumbent; seta of antennæ very long; wings with a complete central cell. Mcq. pl. 8. f. 13.

HEMERODROMIA *Hoff.* Sicus *Latr.* 8 sp. *Ta. Mantispa.* Pz. 103. 16.
Anterior coxæ elongate; fore femora incrassate; fore tibiæ curved (*fig.* 129. 9.).

TACHYDROMIA *Mcq.* (1827). Tachypeza *Meig.* (1830). 11 sp. *M. arrogans* L. Curt. 477.
Anterior coxæ short; fore thighs thickened, serrated; fore tibiæ spined on the inside; wings veined, as in *fig.* 129. 8.; antennæ 2 jointed, with a long seta.

PLATYPALPUS *Mcq.* Tachydromia *Meig.* v. 6. 40 sp. *Cal. cursitans* F.
Differs from the last in having the middle thighs thicker than the anterior, and spined beneath; transverse nervures oblique. Meig. 3. t. 23. f. 23.

ELAPHROPEZA *Mcq.* Tachydromia *Fall.* 1 sp. *T. ephippiata* Fall.
Wings without an anal or discoidal cell; three posterior cells; legs simple. Mcq. pl. 8. f. 14.

DRAPETIS *Meig.* ——— 5 sp. *D. exilis* Meig. Curt. 397.
Short, broad; legs long, simple; antennæ as long as the head, 3-jointed, third ovate-conic; seta long, angulated at base; no discoidal cell; anal nerve straight.

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* "Macquart has divided *Heleodromia* into two genera, but the name should be retained for the second division; the type illustrated by Curtis belonging to this, and the name applying to their aquatic habits: (has not *Hydrodromia* been employed among *Crustacea* ?). I would propose to substitute *Sciodromia* as the generic name of the first division. Meigen is inclined to unite them to *Brachystoma*; but the nervure surrounding the entire wing sufficiently discriminates them. *Paramesia* Macq. is synonymous with *Heleodromia*, and *P. Roberti* seems to be *H. fontinalis*. The two genera with *Ardoptera* form a small group between *Hemerodromia* and the proper *Empidæ*." (*Haliday MSS.*)

Family 7. (or 13.) *HYBOTIDÆ.* (Hybotinæ *Meig.*, *Mcq.* Asilidæ p. *Steph.*)

HYBOS *Fab.* Acromyia *Bon.* 9 sp. *Tab. funebris* F. My fig. 129. 10.
Antennæ apparently only 2-jointed; seta long; hind femora thick and spined.

OCYDROMIA *Hoff.* ——— 6 sp. *Oc. glabricula* Fall. Meig. t. 21. f. 23.
Antennæ apparently only 2-jointed, second joint short; seta long; proboscis slightly exserted; legs slender.

ŒDALEA *Meig.* Empis *Fall.* 2 sp. *E. hybotina* Fall. Meig. t. 21. f. 27.
Third joint of antennæ long; style very short; hind thighs rather thick; proboscis slightly porrect.

SPANIA *Meig.* ——— 2 sp. *S. nigra* Meig. t. 66. f. 12.
Proboscis slightly exserted; antennæ apparently 2-jointed, second joint elongate-oval; style short; legs slender; two submarginal, four posterior cells.

Obs. Mr. Haliday considers this g. to belong to the Leptidæ. (*Ann. N. H.*)

MICROPHORUS *Mcq.* Trichina *Meig.* 6 sp. *Tr. clavipes.*
Third joint of antennæ long; style rather long; proboscis not extending beyond the head. Meig. t. 66. f. 10.

RAGAS *Wlk.* ——— 1 sp. *R. unica* Wlk.
Like Microphora, but with the longitudinal nerve emitting a branch at the apex.

CYRTOMA *Meig.* ——— 6 sp. *C. atra.* Meig. t. 33. f. 5.
Proboscis very short, conic; palpi very small; eyes contiguous in both sexes; antennæ 2-jointed; seta short; hind tibiæ thick at tips; basal joint of hind tarsi broad.

OPETIA *Meig.* ——— 2 sp. *O. nigra* Meig. Curt. 489.
Proboscis very short; antennæ 3-jointed, third joint long, subfusiform; seta long; legs simple; wings with seven longitudinal nerves, the fifth furcate.

Family 8. (or 14.) *ASILIDÆ* Leach. (Asilici *Meig.*, *Mcq.*, *Latr.*)

GONIPES *Latr.* Leptogaster *Meig.* 2 sp. *As. cylindrica* D. G.
Abdomen very long, cylindrical; tarsi without any pulvilli; antennæ with a terminal style. Meig. t. 21. f. 16.

DIOCTRIA *Meig.* Erax p. *Scop.* 12 sp. *As. Œlandica* L. Meig. t. 19. f. 24.
Style of antennæ obtuse, 2-jointed; tarsi with two pulvilli; abdomen long, subclavate.

DASYPOGON *Meig.* Erax p. *Scop.* 2 sp. *D. Diadema* Fab.
Style of antennæ conical; tarsi with two pulvilli; palpi short, biarticulate. St. pl. 45. f. 1.

LEPTARTHRUS *Steph. Cat.* Dasypogon p. *Curt.* 1 sp. *D. brevirostris* M.
Differs from Dasypogon in having the basal joint of the hind tarsi ♂ greatly elongated and slender. Curt. 153.

LAPHRIA *Fab.* Asilus p. *Linn.* 1 sp. *L. nigra* Meig. Curt. 94.
Antennæ without a terminal style; thighs often thickened; tibiæ curved; fourth posterior cell of the wing closed, submarginal cell appendiculated.

ASILUS *Linn.* ——— 15 sp. *A. crabroniformis* L. Curt. 46.
Terminal style of antennæ setaceous, naked; tarsi with two pulvilli; wings with two discoidal cells.

Family 9. (or 15.) *MYDASIDÆ* Westw. (Mydasii *Latr.* Mydasidæ p. *Leach.*)

There is no British species of this family.

Family 10. (or 16.) *THEREVIDÆ* Westw. (Xylotomæ *Meig.*, *Mcq.* Mydasidæ p. *Leach.*)

THEREVA *Latr.* Nemotelus p. *D. G.* 11 sp. *Musca plebeia* L.
Antennæ as long as the head, terminal joints elongate-conic; style 2-jointed. Meig. pl. 15. f. 8.

Family 11. (or 17.) *LEPTIDÆ* Westw. (Leptides *Meig.*, *Mcq.* Rhagionidæ *Leach.*)

LEPTIS *Meig.* Rhagio *Fab.* 8 sp. *M. scolopacea* Linn. Curt. 705.
Palpi incurved; style of antennæ terminal.

CHRYSOPILUS *Mcq.* Leptis *Fab.* 5 sp. *L. Diadema* Linn. Curt. 713.
Palpi recurved; style of antennæ terminal.

ATHERIX *Meig.* Leptis p. *Fab.* 5 sp. *L. Ibis* Fab. Curt. 26.
Palpi porrected; third joint of antennæ very short, semiglobular; style dorsal.

Obs. Spania, referred to this family by Macquart and Haliday, differs in having only 2-jointed antennæ.

Family 12. (or 18.) *DOLICHOPIDÆ* Leach. (Dolichopodes *Meig.*)

MACHÆRIUM *Hal.* ——— 1 sp. *M. maritimæ* Hal. Z. I. pl. 15. f. 11.
Third joint of antennæ very long, excised beneath; apex linear; style short, 2-jointed; eyes apart; wings parallel, incumbent.

DIAPHORUS *Meig.* ——— 2 sp. *D. flavo cinctus* Hoff.
Antennæ with third joint patelliform, with a dorsal villose seta; eyes confluent; abdomen ♂ with two filaments at the tip; wings incumbent, parallel. Meig. pl. 34. f. 8.

PSILOPUS *Meig.* Dolichopus p. *Fab.* 7 sp. *D. platypterus* Fab.
Antennæ with third joint patelliform, villose, with a dorsal villose deflexed seta; eyes apart; wings incumbent, parallel, with a curved transverse nerve at the tip. Meig. pl. 34. f. 14.

CHRYSOTUS *Meig.* Dolichopus p. *Fab.* 9 sp. *D. nigripes* Fab.
Antennæ with third joint patelliform, villose, with an apical, villose, deflexed seta; eyes apart; abdomen ♂ with two filaments at the tip; wings incumbent, subdivaricate. Meig. t. 35. f. 10.

RHAPHIUM *Meig.* ——— 5 sp. *R. longicorne* Meig. Curt. 568.
Antennæ approximate, with third joint in ♂ elongate, compressed; style subapical, 2-jointed; eyes not confluent; wings incumbent, parallel.

PORPHYROPS *Meig.* Dolichopus p. *Fab.* 28 sp. *D. diaphanus* Fab.
Antennæ, with third joint oblong-acute, with a villose deflexed seta; eyes apart; abdomen ♂ with two filaments; wings incumbent, parallel. Curt. 541.

Obs. Mr. Haliday retains P. diaphanus as the type of his subgenus Porphyrops, but Macquart gives it as that of his genus Argyra. P. pallidus *Meig.* is the type of Haliday's subgenus Plectropus; and P. riparius *Meig.* that of his subgenus Perithinus (*Z. I.*)

MEDETERUS *Meig.* HYDROPHORUS *Fall.* 21 sp. *M. regius* Fab. Curt. 162.
Antennæ with third joint short, subovate, compressed, with a dorsal 2-jointed seta; eyes apart; abdomen ♂ with two filaments; legs long and slender; wings incumbent, parallel.

Obs. Macquart separates H. nebulosus *Fall.* and some others under Fallen's generic name Hydrophorus.

SYBISTROMA *Meig.* DOLICHOPUS *Ahr.* 2 sp. *D. discipes* Ahr.
Third joint of antennæ oblong, compressed; seta long, 2-jointed, basal joint longest. Meig. pl. 34. f. 19.

DOLICHOPUS *Latr.* SATYRA *Meig.* olim. 52 sp. *M. nobilitatus* Linn.
Third joint of antennæ trigonate, with a pubescent dorsal seta; eyes apart; abdomen ♂ with two membranous ciliated plates. My fig. 130. 9.

ORTHOCHILE *Latr.* ——— 1 sp. *O. nigrocærulea* Latr.
Proboscis exserted, perpendicular; palpi acute, incumbent. Meig. pl. 36. f. 5.

Family 13. (or 19.) *SCENOPINIDÆ* Westw. (Scenopinii, Megacephali, Platypezinæ, and Oxypteræ *Meig.*)

SCENOPINUS *Latr.* ATRICHIA *Schr.* 8 sp. *M. fenestralis* L. Curt. 609.
Head moderate; eyes confluent ♂; antennæ 3-jointed; third joint elongate-conic; seta 0; first longitudinal nerve emitting a branch at the tip; legs simple.

PIPUNCULUS *Latr.* CEPHALOPS *Fall.* 12 sp. *P. campestris* Latr. Curt. 757.
Head large, subglobose; abdomen small; apex incurved in ♀; third joint of antennæ ovate or acute, with a long basal seta.

CHALARUS *Wlk.* ATELENEVRA *Mcq.* 2 sp. *Pip. spurius* Fall.
Differs from Pipunculus in wanting the large submedial cell. Meig. pl. 33. f. 24.

PLATYPEZA *Meig.* ——— 11 sp. *P. boletina* Fall. Meig. pl. 33. f. 10.
Last joint of antennæ oval, with a long terminal seta; middle vein of wings emitting an oblique branch at the tip.

CALLOMYIA *Meig.* ——— 5 sp. *C. amœna.* Meig. t. 33. f. 13.
Head moderate; third joint of antennæ pointed at tip, with a long terminal seta; middle longitudinal nerve simple at tip; hind tarsi dilated.

ATELESTUS *Wlk.* Ent. Mag. 18. 229. ——— 1 sp. *A. sylvicola* Wlk.
" Callomyiæ et Platypezæ similis, at alarum nervi aliter collocati "!! (*Walker, l. c.*)

LONCHOPTERA *Meig.* DIPSA *Fall.* 8 sp. *L. lutea* Pz. Curt. 761.
Wings long, pointed at the tip (*fig.* 132. 15.); discoidal cell 0.

Stirps 4. Athericera *Latr.*

Family 1. (or 20.) *SYRPHIDÆ* Leach. (Syrphici *Meig.*)

CERIA *Fabr.* CONOPS p. *Schr.* 1 sp. *M. Conopsoides* L. Curt. 186.
Head with a frontal horn supporting the antennæ.

MICRODON *Illig.* APHRITIS *Latr.* 3 sp. *M. apiformis* D. G. Curt. 70.
Short, thick; antennæ frontal, long; scutellum with two points.

CHRYSOTOXUM *Meig.* MILESIA p. *Fab.* 8 sp. *M. bicinctum* L. Curt. 653.
Abdomen ovate, subdepressed; antennæ frontal, second joint long; scutellum unarmed.

PSARUS *Fab.* ——— 1 sp. *P. abdominalis* F.? Meig. pl. 27. f. 12.
Antennæ inserted upon a short pedicle, second joint long; abdomen linear.

PARAGUS *Latr.* Scæva p. *Fab.* 6 sp. *P. arcuatus* Meig. Curt. 593.
Antennæ frontal, short, second joint short, third long; face convex, without a protuberance; abdomen elongate-ovate.

ASCIA *Meig.* Milesia p. *Fall.* 6 sp. *M. podagrica* F. Pz. 59. 16.
Abdomen subclavate; first and second joints of antennæ very short, third oblong-ovate; nose prominent.

SPHEGINA *Meig.* Milesia p. *Fall.* 3 sp. *M. clunipes* Fall.
Abdomen clavate; first and second joints of antennæ very short, third rounded; hind thighs thick. Meig. pl. 28. f. 5.

DOROS *Meig.* (*Illig.* Mag.) Milesia p. *Fab.* 1 sp. *S. conopseus* F.
Abdomen clavate; head obtusely conical; antennæ distant; hind legs simple. Pz. 45. 22.

BACCHA *Fab.* ——— 6 sp. *B. elongata* F. Curt. 737.
Abdomen much elongated, clavate; face obliquely truncate beneath; hind legs thin.

EUMERUS *Meig.* Pipiza p. *Fall.* 6 sp. *E. ornatus* M. Curtis, 749.
Abdomen elongate-ovate; segments constricted; hind thighs thick, spinose; tibiæ bent; scutellum subdenticulate.

XYLOTA *Meig.* (A.) Syritta *Enc. M. & Mcq.* 1 sp. *M. pipiens* L.
Hind thighs elongate-ovate, dilated at tip; basal joint of hind tarsi short, dilated; face scarcely tubercled; eyes with a large portion not united behind in ♂; palpi conical. Pz. 32. 20.

MICRAPTOMA *Westw.* { Xylota B. *Meig.* / Xylota *Enc. M. & Mcq.* } 6 sp. *M. segnis* L.
Differs from Xylota in the palpi being subcylindric, and in the transverse nervure of the middle of the wing being more or less oblique, and posterior coxæ tubercled or spined. Curtis, 425.

MYOLEPTA *Newm.* Xylota p. *Mcq.* 1 sp. *M. luteola* Gm.
Differs from the last in the posterior coxæ being simple; hypostoma porrected and notched.

BRACHYPALPUS *Macq.* Spilomyia *Steph., Meig.*? 1 sp. *M. femorata* L.?
Body villose; palpi short; posterior femora elongated, spined; scutellum not margined.

CRIORHINA *Hoff.* Milesia B. *Meig.* 5 sp. *Cr. asilica* Fall. Pz. 91. 21.
Robust, hirsute; basal joint of antennæ subelongate, third broader than long; style naked; submarginal cell foot-shaped.

MILESIA *Fab.* Milesia D. b. p. *Meig.* 1 sp. *M. speciosa* Fab. Curt. 34.
Abdomen cylindric, sericeous; hind legs simple; face with a frontal protuberance; antennæ with the third joint large, round; style naked.

PIPIZA *Meig.* Eristalis p. *Fab.* 22 sp. *M. noctiluca* L. Curt. 669.
Abdomen elongate-ovate, pilose; head with a slight frontal prominence; nose rounded; third joint of antennæ subquadrate; seta short.

PSILOTA *Meig.* ——— 1 sp. *P. anthracina* Meig. pl. 29. f. 20.
Abdomen short, ovate; legs slender; antennæ with the third joint oval; face with a frontal prominence; nasus porrected, notched at tip.

RHINGIA *Scop.* Conops p. *Linn.* 3 sp. *C. rostrata* L. Curt. 182.
Nose porrected, as long as the head, notched at the tip.

BRACHYOPA *Hoffm.* RHINGIA p. *Fall.* 2 sp. *M. conica* Pz. Meig. pl. 30. f. 6.
Wings large; abdomen short, ovate-conic; head with a frontal protuberance; nasus short; legs simple; third joint of antennæ round; seta pilose at base.

CHRYSOGASTER* *Meig.* ERISTALIS p. *F.* 13 sp. *M. viduata* L.
Abdomen depressed, ovate; antennæ short; face generally with a protuberance in ♂; third joint of antennæ rounded; terminal nerve of the first posterior cell parallel with the margin of the wings. Meig. pl. 30. f. 17.

ORTHONEURA *Macq.* CHRYSOGASTER *Meig.* 2 sp. *C. nobilis* Meig.
Differs from Chrysogaster in the third joint of antennæ elongate, narrow, and the terminal nerve of the first posterior cell perpendicular. Meig. pl. 30. f. 9.

SYRPHUS *Ste., Meig.*, nec *Fab.* CHEILOSIA *Enc. M., Macq.* 24 sp. *M. ruficornis* L.
Abdomen elliptic, depressed, not banded; third joint of antennæ oval; legs slender; tarsi simple in both sexes. Curt. 753.

SCÆVA *Fab., Ste. Cat., Curt.* SYRPHUS *Enc. M., Macq.* 28 sp. (Sp. typ. *Fab.*) *Pyrastri* L.
Abdomen elliptic, depressed, banded; tarsi simple in both sexes; sexual organs of ♂ concealed. Curt. 509.

Obs. Stephens gives S. ornatus and festivus, as the types of a distinct unnamed subgenus (1244.); they form division 2. subdivision 1. A. of Syrphus, in *Enc. Méth.* Macquart unites them with Doros.

CHEILOSIA *Hoff.* { SPHÆROPHORIA *Enc. M.* / [G. 1242. *St. Cat.*] } 6 sp. *M. scripta* L. Meig. pl. 30. f. 35.
Tarsi simple in both sexes; abdomen fasciated, linear, very long in ♂, in which sex the sexual organs are exposed.

PLATYCHEIRUS *Enc. M.* CHEILOSIA *Hgg.* (*St. Cat.*) 17 sp. *S. scutatus.*
Anterior tarsi dilated in the males; abdomen linear, fasciated. Meig. pl. 30. f. 31.

SERICOMYIA *Latr.* MUSCA p. *Linn.* 3 sp. *S. Lappona* L. Meig. pl. 31. f. 9.
Broad, robust; third joint of antennæ orbicular; seta plumose; hind legs not spined.

TROPIDIA *Meig.* ERISTALIS p. *Fall.* 1 sp. *T. rufomaculata.* Curt. 401.
Elongate; hind thighs thick, with a strong tooth near the tip; third joint of antennæ large, rhomboidal; seta naked; nose keeled.

MERODON *Fab.* MILESIA p. *Latr.* 2 sp. *M. clavipes* F. Curt. 98.
Robust, hairy; hind thighs with a strong apical tooth; face without prominences, third joint of antennæ oval.

HELOPHILUS *Meig.* ERISTALIS p. *Fab.* 8 sp. *M. pendulus* L. Curt. 429.
Robust, hirsute; fourth longitudinal nerve greatly curved before the apex; posterior thighs simple; eyes ♂ not contiguous.

ERISTALIS *Fab.* HELOPHILUS *Leach.* 17 sp. *M. tenax* L. Curt. 432.
Robust, hirsute; fourth longitudinal nerve greatly curved before the apex; posterior thighs simple; eyes ♂ contiguous; seta of antennæ naked or plumose.

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* "*Chrysogaster.*—Macquart has generically distinguished the species of Meigen's second division. But there remains confounded a species of peculiar characters; viz. *Chr. discicornis* (♂—*Chr. metallicus* ♀), with the front broad in both sexes—the labrum, palpi, and maxillæ all nearly equal in length to the labium. *Chr. grandicornis*, I suppose, is in the same circumstance. The broad front has misled Meigen as to the sex." (*Haliday's MSS.*)

VOLUCELLA *Geoff.* { PTEROCERA *Meig.* olim / SYRPHUS sp. typ. *Fab.* } 5 sp. *M. mystacea* L. Curt. 452.

Robust; fourth longitudinal nerve straight; nose porrected; antennæ with the third joint kidney-shaped; seta very plumose.

Family 2. (or 21.) *CONOPIDÆ* Leach. (Conopsarii *Meig.* Conopsariæ and Myopariæ *Macq.*)

CONOPS *Linn.* ——— 7 sp. *C. vesicularis* L. Curt. 377.

Proboscis long, elbowed near the base, and porrected; antennæ long; ocelli 0.

ZODION *Latr.* MYOPA *Fab.* 2 sp. *M. cinereum* F.

Proboscis long, elbowed near the middle, and porrected; antennæ short; ocelli three.

MYOPA *Fab.* CONOPS p. *Linn.* 10 sp. *C. buccata* L. Curt. 677.

Proboscis elbowed near the base, and again about the middle; ocelli three.

Family 3. (or 22.) *MUSCIDÆ* Westw. (Muscidæ and Stomoxydæ *Leach.* Muscides, Stomoxydes, and Trineuræ *Meig.* Myodaires *Rob. Desv.* Muscides *Macq.*)

Subfamily 1. *Creophilæ* Latr., Macq. (Calypteratæ *R. D.*)

A. TACHINARIÆ *Macq.*

ECHINOMYIA *Dum.* TACHINA p. *Fabr.* 10 sp. *M. grossa* L.

Broad; face naked; epistome prominent; antennæ deflexed, second joint elongated. My fig. 131. 11.

Obs. M. ferox *Linn.* belongs to the s. g. *Fabricia* R. D., and E. ursina to *Servillea* R. D.

MICROPALPUS *Macq.* TACHINA p. *Meig.* 2 sp. *T. fulgens* Meig.

Broad; palpi short, slender, and terminated by a seta; face naked; epistome prominent; second joint of antennæ elongated, but not longer than third.

GONIA *Meig.* TACHINA p. *Fall.* 4 sp. *M. capitata* D. G. Curt. 533.

Robust; head swollen; face vertical; tarsal claws and pulvilli minute in both sexes; seta of antennæ angulated, its second joint long.

THRYPTOCERA *R. D.* TACHINA p. *Meig.* 7 sp. *T. setipennis* Meig.

Narrow; face vertical, naked, not swollen; style of antennæ elbowed; proboscis not elongated.

SIPHONA *Meig.* BUCENTES *Latr.* 4 sp. *M. geniculata* D. G.

Style of antennæ elbowed; proboscis elongated (*fig.* 132. 8.). Meig. t. 37. f. 24.

TRIXA *Meig.* CRAMERIA *R. D.* 4 sp. *Tr. dorsalis* Meig. p. 40. f. 16.

Broad; second joint of the style of antennæ short; proboscis short; abdomen oval; antennæ very short.

NEMORÆA *Macq.* TACHINA p. *Meig.* 7 sp. *M. radicum* F.

Broad; second joint of antennæ elongate, third scarcely twice as long as the second; abdomen oval.

Obs. N. radicum *F.* belongs to the s. g. *Erigone* R. D.; N. puparum *Meig.* to the s. g. *Panzeria* R. D.; N. 4-pustulata to the s. g. *Nemoræa* R. D.

SENOMETOPIA *Macq.* TACHINA p. *Meig.* 5 sp. *T. hortulana* Meig.

Broad; second joint of antennæ short, third three times as long; seta not elbowed; abdomen oval.

Obs. T. spinipennis belongs to the s. g. *Pales* R. D. (Triarthria *St. Cat.*)

EURIGASTER *Macq.* TACHINA *Meig.* 11 sp. *T. pallipes* Fall.
Broad; second joint of antennæ very short, third joint four or six times as long; eyes often villose; face oblique.

MASICERA *Macq.* TACHINA *Meig.* 4 sp. *T. pruinosa* Meig.
Moderately broad; abdomen cylindric, rounded; face slightly oblique; third joint of antennæ very long, front slightly prominent.

METOPIA *Meig.* ARABA *R. D.* 2 sp. *M. leucocephala* Pz. 54. 14.
Rather narrow; face oblique, margined with setæ; abdomen more or less conic; eyes generally naked; forehead very prominent.

EXORISTA *Meig.* TACHINA p. *Macq.* 12 sp. *M. larvarum* L.
Third joint of antennæ scarcely double the length of the second; forehead narrow ♂; first posterior cell generally open, at a distance from the apex of the wing.

LYDELLA *Macq.* TACHINA *Meig.* 8 sp. *T. modesta* Meig.
Narrow, or moderately broad; face more or less oblique, margined with setæ; epistome not prominent; third joint of antennæ not more than thrice the length of the second.

TACHINA *Meig.* ——— 4 sp. *T. consobrina* Meig.
(Cinereous); antennæ elongate, third joint of antennæ not more than double the length of the second; eyes naked; style naked; abdominal segments without setæ in the middle.

CHRYSOSOMA *Macq.* GYMNOCHÆTA *R. D.* 1 sp. *T. viridis* Fall.
Moderately wide (golden green); face oblique; eyes villose; abdominal segments setose in the middle.

CLYTIA *Macq.* MUSCA p. *Pz.* 1 sp. *T. continua* F. Pz. 60. 19.
Antennæ short, third joint scarcely longer than the second; facial setæ short; head broad; epistome prominent.

MILTOGRAMMA *Meig.* TACHINA *Fall.* 2 sp. *T. punctata* M. Curt. 529.
Abdomen without setæ; antennæ short, drooping, third joint twice the length of the second; head of moderate size; fourth joint of fore tarsi ♂ with long curved hairs.

MYOBIA *R. D.* EXORISTA p. *St.* 7 sp. *T. pacifica* M.
Narrow (yellow-coloured); style of antennæ pubescent; abdomen cylindric; head nearly hemispherical; face oblique, generally naked; epistome prominent.

ZOPHOMYIA *Macq.* TACHINA p. *Meig.* 9 sp. *M. tremula* L.
Narrow (shining black); style pubescent, thick at base; head nearly spherical; face naked; epistome oblique; eyes mostly villose; abdomen elongate-ovate.

Obs. T. ænea *M.* and chalybeata *M.* belong to the s. g. *Macquartia* R. D.

CASSIDÆMYIA *Macq.* RHINOPHORA *R. D.* 3 sp. *T. gagatina* M.
Narrow (shining black); style pubescent, thick at base; abdomen cylindric, without setæ at the middle of the segments; antennæ short; eyes naked.

DEXIA *Latr.* SERICOCERA *Macq.* 16 sp. *O. volvulus* Fab. Meig. pl. 43. f. 19.
Narrow; face vertical; head hemispherical; antennæ long, third joint cylindric; style somewhat villose; legs rather long.

Obs. D. volvulus belongs to the s. g. *Phyllomyia* R. D.; M. compressa *Fab.* (lateralis, Pz. 7. 22.) to *Mentho* R. D.; and D. leucozona, Pz. 104. 19., and nigripes, Pz. 104. 18. to *Thelaira* R. D.

PTILOCERA *Mcq.* Phyto *R. D.* 3 sp. *melanocephala* Meig.
Narrow; forehead narrowed ♂; eyes naked; abdomen cylindric; antennæ short; second joint hooked; legs ♂ of ordinary length.

MELANOPHORA *Meig.* Tephritis *Fab.* 2 sp. *M. roralis* L. Donov. pl. 419.
Narrow, small, shining black, face mostly naked, more or less elevated; style of antennæ tomentose or slightly villose; abdomen cylindric; eyes naked.

LEUCOSTOMA *Meig.* olim. Meigenia *R. D.* 4 sp. *M. floralis* Fall.
Abdomen ovate; two basal joints of antennæ very short, third linear, long; wings as in Meig. t. 41. f. 24.; eyes naked.

ERIOTHRIX *Meig.* Musca *Fab.* 1 sp. *M. lateralis* Fab. Donov. pl. 31. f. 3.
Abdomen conic; eyes hairy; proboscis greatly elongated, slender (Meigen, t. 41. f. 17.); wings as in Meig. pl. 41. f. 26.

B. Ocypteratæ *R. D., Mcq.* Rhizomyzæ *Fall.*

PHANIA *Meig.* Tachina *Fall.* 3 sp. *P. curvicauda.* Meig. pl. 40. f. 10.
First posterior cell open.

OCYPTERA *Latr.* Musca *L.* 2 sp. *O. brassicaria* Fab. Curtis, 629.
First posterior cell closed.

C. Gymnosomees *Mcq.* Gastrodæ *R. D.*

GYMNOSOMA *Meig.* Tachina *F.* 1 sp. *M. rotundata* L. Pz. 20. 19.
Abdomen globose.

D. Phasianeæ *R. D., Mcq.*

XYSTA *Meig.* Thereva *Fab.* 1 sp. *X. cana* Hal. Meig. 39. f. 5.
Cylindric; abdomen oval; first posterior cell open at tip; second and third joints of antennæ subequal.

PHASIA *Latr.* Alophora *R. D.* 2 sp. *Co. subcoleoptrata* L.
Broad, depressed; abdomen rounded; first posterior cell closed, with a short peduncle. Meig. pl. 39. f. 13.

ELOMYIA *R. D.* Phasia *Meig.* 1 sp. *P. cana* Hgg.
First posterior cell closed, without a peduncle.

HYALOMYIA *R. D.* Phasia p. *Latr.* 4 sp. *P. semicinerea* Meig.
First posterior cell closed, with a long peduncle. Curtis, 697.

E. Stomoxydeæ *Westw.* Dexiaires *Mcq.*

PROSENA *St. F. & Serv.* Stomoxys *Meig.* 1 sp. *S. Sibirita* Fab. Curt. 665.
Seta of antennæ bipectinated; proboscis thrice as long as the head, recurved.

STOMOXYS *Fab.* Conops *Linn.* 1 sp. *C. calcitrans* L. Sam. pl. 9. f. 7.
Seta 1-pectinated; proboscis twice as long as the head, incurved; palpi very short.

HÆMATOBIA *Desv.* Stomoxys *Meig.* 2 sp. *S. irritans* L. Meig. t. 38. f. 8.
Proboscis twice as long as the head; palpi as long as the labrum.

DINERA *Macq.* Dexia p. *Meig.* 1 sp. *D. grisescens* Meig.
Cylindric; proboscis rather short; second joint of antennæ hooked; abdomen cylindric-ovate; first posterior cell closed.

——— { Dexia *Mcq.* nec *Latr.* / Dexilla *Westw.* } 3 sp. *D. rustica* Meig.
Cylindric; proboscis short and membranous; abdomen cylindric-conic, with two setæ in the middle of each segment. Harr. Exp. pl. 41. f. 43.

F. Sarcophagiens *Mcq.*

SARCOPHAGA *Meig.* Myophora *R. D.* 11 sp. *M. carnaria* L.
Third joint of antennæ thrice as long as the second; style of antennæ setose; setæ above and below of equal length. Shaw, G. Z. pl. 107. f. sup.

CYNOMYIA *R. D.* Sarcophaga *Meig.* 1 sp. *M. Mortuorum* L.
Third joint of antennæ four times as long as the second; upper setæ of the style longer than the inferior. Donov. pl. 471. f. 2.

G. Muscies *Mcq.*

LUCILIA *R. D.* Musca *Linn., Curt.* 32 sp. *M. Cæsar.* Curtis, 549.
Metallic-coloured; face rather oblique; third joint of antennæ four times as long as the second; epistome not prominent.

Obs. M. Cæsar is the type of the s. g. *Lucilia* R. D., M. regina *M.* belongs to the s. g. *Phormia* R. D., and M. cadaverina *L.* and serena *Meig.* to *Pyrellia* R. D.

CALLIPHORA *R. D.* Musca *L.* 7 sp. *M. vomitoria* L. Pz. 10. 19.
Head depressed; epistome prominent; third joint of antennæ four times as long as the second; style plumose; abdomen hemispherical.

Obs. M. vomitoria is the type of the s. g. *Calliphora* R. D., and M. cærulea and azurea *M.* belong to the s. g. *Melinda* R. D.

MUSCA *L.* ——— ? sp. *M. domestica* Linn. Harr. Exp. pl. 41. f. 44.
Epistome scarcely prominent; third joint of antennæ thrice the length of the second; style plumose; first posterior cell reaching the margin near the tip.

Obs. M. vitripennis *Meig.* belongs to the s. g. *Plaxemyia* R. D. (P. sagillatrix *R. D.*)

POLLENIA *R. D., Mcq.* Musca p. *Meig.* *M. rudis* Fabr.
Thorax covered with down; epistome scarcely prominent; antennæ short, second joint hooked, third twice as long as second; wings almost incumbent.

Obs. M. Lanio *Fab.*, atramentaria *Meig.*, and varia *Meig.* belong to the s. g. *Nitellia* R. D.

MESEMBRINA *Meig.* Musca p. *Linn.* 1 sp. *M. Meridiana* L.
Broad; antennæ with the third joint twice or thrice as long as the second; mediastinal cell far extending beyond the base of the first posterior cell. Donov. pl. 471. fig. 2.

CURTONEURA *Mcq.* Musc. vagantes *R. D.* 8 sp. *M. maculata* Fab.
First posterior cell but slightly narrowed at the tip, reaching the posterior margin; style plumose; epistome slightly prominent. Pz. 44. 23.

Obs. M. maculata *Fab.*, and meditabunda *F.* Pz. 44. 23., is the type of *Graphomyia* R. D.; M. cyanella *Meig.* belongs to the s. g. *Dasyphora* R. D.; M. Hortorum and importuna *Meig.* to *Morellia* R. D.; M. Pascuorum, stabulans, and Pabulorum, to *Muscina* R. D.

Subfamily 2. *Anthomyzidæ Latr., Mcq.* (Mesomydæ *R. D.*)

ARICIA *Mcq.* Anthomyia *Meig.* 16 sp. *M. lardaria* Fab.
Style of antennæ plumose; abdomen oval, setose, alulets rather large; wings extended. Harr. Exp. pl. 36. f. 52.

Obs. A. lardaria *Fab.* belongs to the s. g. *Macrosoma** R. D., A. lucorum *Meig.* to the s. g. *Mydina* R. D., A. incana *Meig.* to the s. g. *Fellæa* R. D.,

* I think Desvoidy's genus *Macrosoma* might be retained; the other genera of R. D, which Macquart has here united, were too intimately blended." (*Haliday MSS.*)

A. errans *Meig.* to the s. g. *Trennia*, A. signata *Meig.* to *Phaonia* R. D., A. pallida *Fab.* and testacea *Fab.* to *Rohrella* R. D., A. pagana *Meig.* to *Mydæa* R. D., A. urbana *Meig.* to *Fellæa* R. D., and A. impunctata *M.* and modesta *M.* to *Aricia* R. D.

SPILOGASTER *Mcq.* ANTHOMYIA *Meig.* 8 sp. *M. quadrum* Fab.
Style of antennæ with short hairs; abbomen ♂ generally oblong and setose, second and third segments marked with four spots; alulets rather large. Harr. Exp. pl. 43. f. 62.

Obs. M. uliginosa *Fall.* belongs to the s. g. *Rohrella* R. D., A. pertusa *Meig.* to *Helina* R. D., A. quadrum *Meig.* to *Mydina* R. D.

HYDROPHORIA *Mcq.* ARICINÆ LITTORALES *R. D.* 31 sp. *M. nigrita* Fall.
Style of antennæ setose; abdomen cylindric-conic, penultimate segment armed beneath with two elongate appendages; alulets of moderate size.

HYDROTÆA* *Desv.* ANTHOMYIA *Meig.* 14 sp. *M. meteorica* L. Curt. 768.
Style tomentose; abdomen oblong-ovate, without appendages; anterior femora ♂ with one or two strong teeth, posterior with a strong spine; middle legs longest.

Obs. H. palpata is the type of the s. g. *Blainvillia* R. D., having unarmed femora.

OPHYRA *Mcq.* ANTHOMYIA *Meig.* 15 sp. *A. leucostoma* Meig.
Style of antennæ naked; frontal setæ short; abdomen oval ♂ very setose, ♀ naked; thighs rather thick; alulets moderate-sized; transverse nerves near together.

LIMNOPHORA *Mcq.* ANTHOMYIA *Meig.* 8 sp. *M. compuncta* Meig.
Style of antennæ tomentose; abdomen oblong, not appendiculated; alulets moderate; legs simple.

LISPE *Meig.* MUSCA *De Geer.* 3 sp. *M. tentaculata* D. G. Meig. pl. 45. f. 15.
Head spheroidal; palpi spatulate; style of antennæ with the upper setæ longer than the lower; forehead broad in both sexes; alulets moderate-sized.

HYLEMYIA *Mcq.* HYLEMYDÆ *R. D.* 15 sp. *A. hilaris* Meig.
Alulets small; abdomen cylindric; penultimate segment with two appendages beneath; style of antennæ mostly setose; wings with a stigma.

Obs. O. hilaris belongs to the s. g. *Delia* R. D., A. Cardui *Meig.* to the s. g. *Ægeria* R. D.

DRYMEIA *Meig.* MUSCA *Fall.* 2 sp. *D. obscura* Meig.
Proboscis rather exserted, with long, slender, elbowed lips; style of antennæ tomentose; abdomen cylindric, villose; alulets small.

CHORTOPHILA *Mcq.* ANTHOM. HERBICOLÆ *R. D.* 2 sp. *A. Sepia* Meig.
Head thick; antennæ not reaching the epistome; style tomentose or naked; abdomen cylindric; alulets small; wings without a stigma.

ATOMOGASTER *Mcq.* AZELIDÆ *R. D.* 19 sp. *A. triquetra* Meig.
Antennæ not reaching the epistome; style naked; abdomen narrow, cylindric; anus bicarinated ♀; alulets small; stigma wanting.

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* "Meigen is surely in error in attaching so much importance to the hairy eyes as to separate *occulta* from this genus, of which it has all the characters; even *H. ciliata* has eyes evidently pubescent in ♂." (*Haliday MSS.*)

ERIPHIA *Meig.* ——— 1 sp. *E. aterrima* St. MSS.

Cheeks swollen and setose; abdomen with the fourth segment obliquely truncate; middle tibiæ curved with curved bristles.

HOMALOMYIA *Bouché.* ANTHOMYIA p. *Mcq.* 6 sp. *M. canicularis* Linn.

Style of antennæ tomentose or naked; alulets small; abdomen narrow; epistome not prominent; abdomen without appendages beneath; larvæ furnished with long setose filaments. Harr. Exp. pl. 43.f. 69.

Obs. A. scalaris *Meig.*, *&c.*, belong to the s. g. *Fannia* R. D., A. canicularis to *Philinta* R. D., A. floralis, pratensis, &c., to *Delia* R. D.

ANTHOMYIA* *Meig.*, *Mcq.* p. MUSCA p. *L.* 5 sp. *M. pluvialis* L.

Style of antennæ tomentose or naked; alulets small; abdomen furnished with appendages beneath; epistome more or less prominent; larvæ naked. Donov. pl. 372.

Obs. A. radicum *Meig.* belongs to the s. g. *Egle* R. D.

SCHÆNOMYIA *Hal.* SCIOMYZA and OCTHIPHILA p. *Meig.* 2 sp. *S. fasciata* Meig.

Mouth mystacinous; antennæ approximate at base, wide at the apex; seta naked; abdomen 4-jointed, pilose; wings without any transverse nerve at the tip.

CÆNOSIA *Meig.* MUSCA p. *Fab.* 16 sp. *M. tigrina* Fab.

Forehead broad ♂ ♀; alulets small; stigma wanting; abdomen elongated, compressed, thick at the tip.

Obs. C. tigrina *Meig.* belongs to the s. g. *Caricea* R. D., C. nemoralis *Meig.* to *Palusia* R. D., C. mæans *Meig.* to *Limosia* R. D.

PEGOMYIA *Mcq.* PEGOMYDÆ *R. D.* 14 sp. *A. fulgens* Meig.

Style of antennæ tomentose or slightly villose; abdomen mostly cylindric (testaceous-coloured), with appendages beneath in ♂; alulets very small.

Obs. A. fulgens *Meig.* belongs to the s. g. *Phorea* R. D., M. diaphana *Fall.* to *Phyllis* R. D.

Subfamily 8. *Acalypteræ* Mcq.†

A. SCATOMYZIDES.

CORDYLURA‡ *Fall.* OCYPTERA p. *Fab.* 9 sp. *M. pubera* L. Curt. 485.

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* "I suspect Macquart has gone too far in uniting here all the Choreellæ of *R. D.*; the genus Homalomyia *Bouché*, which includes Fannia, Philinta, Aminta, and Delia of *R. D.*, seems sufficiently characterised, though we are ignorant how far the singular character of the larva (long since figured by Swammerdam) extends. I find two species, apparently undescribed, of a group, I think, requiring to be distinguished, viz.

Cœlomyia. Abdomen ♂ obovatum, ventre concavo toto membranaceo (absque plica aut linea coriacea longitudinali). Facies brevis impressa. Peristoma oblongum. Labium sub-elongatum (membranaceum tamen). Calyptra jam minima (ut in *Homalomyia*, division 2. *Delia* R. D.) Antennæ, pedes, alæque *Homalomyiæ*. Sp. 1. mollissima." (*Haliday MSS.*)

† I am indebted to A. H. Haliday, Esq., for the sketch of the following distribution and notes, upon the acalypterated Muscidæ. I have derived most of the generic characters from the work of Macquart, whose arrangement differs materially from that given below, as does also that of Fallen and other writers upon the Muscidæ.

‡ "The species with naked arista, dilated palpi, and somewhat bristly legs, form *Nupharia* R. D., e. gr. *C. fraterna*. *Delina* has the arista pubescent. *Hydromyza* (Fall.) the tibiæ naked." (*Haliday MSS.*)

Body setose; seta of antennæ feathered; face rather inclined behind; epistome not prominent, having two setæ; third joint of antennæ oblong, truncated.

Obs. M. pubera *L.* is the type of the s. g. *Mosina* R. D., C. spinimana *Fall.* belongs to *Norellia* R. D., and C. albipalpis to *Phrosia* R. D.

S. g. *Cleigastra* Mcq. Cordylura p. *Curt.* —? *Cord. apicalis* Fall.
Seta of antennæ naked or slightly pubescent; body setose; palpi often dilated; face rather inclined behind; epistome not prominent.

Obs. C. apicalis is retained as the type of *Cleigastra*, C. nigrita *Fall.* belongs to *Delina* R. D., C. fraterna, &c., to *Nupharia* R. D., and C. livens *Fab.* Curt. 485. to *Hydromyza* Fall.

S. g. *Myopina* R. D. Cænosia *Meig.* 1 sp. *C. myopina* Meig.
Body setose; abdomen short, curved, terminal segments short, third segment with valve-like appendages beneath; style of antennæ distinctly 2-jointed.

SCATOPHAGA *Meig.* Scatomyza p. *Fall.* 22 sp. *M. stercoraria* L.
Third joint of antennæ long; anterior margin of wings not ciliated; head spherical; body setose. Curtis, 405.

Obs. S. stercoraria is retained as the type of *Scatophaga*; S. litorea *Fall.* belongs to the s. g. *Scatina* R. D., and S. fucorum *Fall.* to *Halithea* A. H. Hal. (2 sp.), the last distinguished by "Arista subnuda; alæ unguiculatæ; tarsi graciliores; femora postica ♂ tuberculo villoso," type H. maritima *Hal.*

THYREOPHORA *Latr.* Musca *Pz.* 1 sp. *T. furcata* Meig. Pz. 24. 22.
Elongate; palpi spatulate; forehead very wide, advanced over the antennæ; third joint of antennæ lenticular; seta naked; hind femora thickened; tibiæ tuberculated.

ORYGMA *Meig.* Psalidomyia *Doum.* 1 sp. *O. luctuosa* Meig.
Head elongate, triangular; face horizontal, with two impressions; legs villose; antennæ short; third joint oval; style naked; thorax elliptic.

CÆLOPA* *Meig.* Copromyza *Fall.* 6 sp. *C. frigida.* Meig. pl. 56. f. 1—6.
Oblong; head rather small; proboscis thick; face short, very concave, very villose; forehead very broad, flat; second joint of antennæ thick; third smaller, lenticular; tibiæ villose.

S. g. *Fucomyia* Hal. Copromyza p. *Fall.* — sp.? *C. frigida* Fab.
Differs from Cælopa in having the face and tibiæ clothed sparingly with setæ.

S. g. *Malacomyia* Hal. ——— 1 sp. *C. Sciomyzina.*
Differs from Cælopa in the arista being villose, and the epistome acutely produced.

B. Borborides. (See Haliday in *Ent. Mag.* vol. iii., Jan. 1836.)

BORBORUS *Meig., Mcq.* Mycetia *R. D.* 9 sp. *C. equina* Fall. Curt. 469.
Winged; arista with the basal joint scarcely distinct, pubescent.

S. g. *Sphærocera* Latr. Borborus p. *Meig.* 5 sp. *B. subsultans* Meig.
Arista with the basal joint scarcely distinct, naked.

S. g. *Apterina* Mcq. Borborus p. *Meig.* 1 sp. *B. pedestris* Meig.
Apterous; arista with the basal joint scarcely distinct, pubescent.

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* "Macquart appears to be in error in identifying with this the *Psalidomyia* of Doumerc, which I consider to be Orygma luctuosa." (*Haliday MSS.*)

S. g. *Limosina* Mcq. Borborus p. *Meig.* 22 sp. *B. sylvaticus* Meig.
Arista jointed at the base; second transverse nerve perpendicular.

S. g. *Heteroptera* Mcq. Borborus p. *Meig.* 1 sp. *C. pusilla* Fall.
Arista jointed at the base; second transverse nervure oblique.

C. Helomyzides.

HELOMYZA *Fallen.* Suillia p. *R. D.* 18 sp. *H. rufa* Fall. Curt. 545.
Wings with the anterior margin ciliated; epistome and fore femora thick and hairy; antennæ with the third joint oval; style villose.

S. g. *Blephariptera* Mcq. Helomyza p. *Curt.* sp. ? *M. serrata* L.
Differs from Helomyza in having the third joint of the antennæ orbicular or lenticular, and the style long, naked, or tomentose.

Obs. *Herbina* R. D., (sp. H. Suilloidea *R. D.*), *Leria* R. D., (M. serrata *Linn.*), and *Œcothea** Hal. (4 sp., type Œc. fenestralis and pallescens *Mcq.*), are given by Mr. Haliday as subgenera of Blephariptera.

HETEROMYZA† *Fall.* Thelida *R. D.* 3 sp. *H. oculata* Fall.
Differs from Blephariptera in having the fore margins of the wings not ciliated; forehead narrowed in ♂.

Obs. Mr. Haliday refers to this genus the subgenera *Lentiphora* R. D., *Thelida* R. D. (H. oculata), *Clusia* Hal., (H. flava *Meig.* nearly allied to Heteroneura), and *Heteromyza*, (type H. occulta *Fall.*)

ACTORA *Meig.* Helcomyza *Curt.* 2 sp. *A. Œstrum* Meig. Curt. 66.
Elongate; head rather large; palpi large; face naked; forehead very broad, flat, obtusely advanced; antennæ short, third joint lenticular; legs, except the middle tibiæ, villose.

DRYOMYZA *Fall.* Dryope *R. D.* 4 sp. *M. flaveola* Fab.
Palpi rather large; face short, concave; epistome prominent, a kind of hood extending over the epistome; third joint of antennæ oval; style finely villose.

LUCINA *M.* Salticella *R. D.* 1 sp. *L. fasciata* Mg. Curt. 621.
Face naked, vertical; head broad; antennæ distant, third joint oval; style naked; abdomen depressed, distinctly 6-jointed; hind legs long; thighs thick, spinose.

SCIOMYZA *Meig.* Dyctia *R. D.* 12 sp. *S. simplex* Meig.
Head rather broad; face perpendicular; epistome not prominent, naked; forehead broader than the thorax; antennæ distant, third joint oblong, obtuse; abdomen depressed.

Obs. The subgenera *Chætocera* R. D. (C. albocostata *Mg.*, *&c.*), *Anticheta*

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* Œcothea *Hal.* "Antennæ articulo tertio orbiculato; arista gracillima, longa, nuda; tibiæ mediæ spinosæ; alæ costa distinctè serrata; areola mediastina minuta." (*Hal.*)

† "Heteromyza *Meigen* is an incongruous mass. Some, as *oculata*, have the spines of the costa, though few and minute, still visible towards the lower edge; these, therefore, differ not materially from *Blephariptera* (Leria *R. D.*). *H. oculata* forms R. D.'s genus *Thelida* *H. furcata* may be taken as the true type; it is allied to *Actora*, and, with that genus, seems to come closer to the type of the *Sciomyzides*. *H. flava* M. has, I think, considerable affinity to *Heteroneura*, with which I once placed it. I have pointed out the principal differences in the *Annals of Nat. History*." (*Haliday's MSS.*)

Hal.* (A. vittata), *Pherbellia* R. D. (S. monilis *Mg.*, *&c.*), *Dyctia* R. D. (S. cinerella *Fall.*), and *Melina* R. D. (M. virgata) are referred to this genus by Mr. Haliday.

TETANOCERA *Dum.* EUTHYCERA *Latr.* 17 sp. *M. Umbrarum* L.
Antennæ as long as the head, second joint equal in length to the third; face not prolonged into a muzzle.

Obs. The subgenera *Tetanocera* R. D. (T. elata *Fall.*), *Pherbina* R. D. (T. Hieracii *Fab.*, reticulata *Fall.*, *&c.*), *Thais* Hal. (S. obliterata *Hal.*), *Limosia* R. D. (T. marginata *Meig.*), *Hydromyia* R. D. (dorsalis *Meig.*, aratoria *Meig.*), *Chione*† R. D. (or Elgiva *Mcq.*, M. cucullaria, &c.), and *Ilione* Hal. (I. lineata *Hal.*) are referred by Mr. Haliday to the genus Tetanocera.

SEPEDON *Latr.* BACCHA *Fab.* 2 sp. *S. Sphegeus* Fall.
Antennæ longer than the head, second joint longer than third; face perpendicular; forehead rugose.

D. OTITIDES ?.

TRIGONOMETOPUS *Mcq.* TETANOCERA *Meig.* 1 sp. *T. frontalis* Mg.
Head long, triangular; face long, horizontal, nearly naked; second joint of antennæ rather long, third conic; style naked; abdomen depressed. Curt. 689.

DORYCERA *Meig.* OSCINIS *R. D.* 1 sp. *D. Graminum.*
Head elongate, obtuse; face convex; forehead much advanced; second joint of antennæ long, compressed, third longer, cultriform; style tomentose. Meig. tab. 57. f. 1—5.

OTITES *Latr.* SCIOMYZA *Meig.* 1 sp.? *O. bucephala* Mg.
Head rather larger; face rather convex, carinated; forehead obtuse, flat; antennæ short, second joint conic, third oval, as long as the second; style naked.

TETANOPS *Fall.* ——— 1 sp. *T. myopina* Fall.
Head conic; face much inclining, with two impressions; third joint of antennæ oval, rounded beneath; style naked; abdomen long, depressed; ovipositor incurved.

E. LOXOCERIDES.

CHYLIZA *Fall.* DASYNA *R. D.* 8 sp. *C. leptogaster* Fall. Meig. t. 51. f. 23.
Epistoma rather prominent, naked; third joint of antennæ oblong, obtuse; style tomentose; abdomen and legs naked; mediastinal nervure simple.

PSILOMYIA *Latr.* { PSILA *Mg.* / OBLICIA *R. D.* } 8 sp. *M. fimetaria* L. Pz. 20. 22.
Thorax naked; abdomen thin, 6-jointed; ovipositor long; third joint of antennæ oblong, compressed; style finely plumose; mediastinal nerve simple.

LOXOCERA *Meig.* MUSCA p. *Linn.* 4 sp. *M. Ichneumonea* L. Pz. 73. 24.
Narrow; face inclined; antennæ very long, third joint filiform, as long again as the head; style tomentose.

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* "Arista plumata; tibiæ cilio præapicali gemino." (*Hal.*)

† The species referred to Chione by Macquart (tom. ii. p. 371.) form the genus *Hydromyia* R. D. (*Haliday's MSS.*)

LISSA *Meig.* Chyliza p. *Fall.* 1 sp. *L. dolium* Fab. Meig. pl. 52. f. 1—4.
Arista villose; forehead tubercled; face with a carina and two impressions; hind thighs thickened; abdomen long, the terminal segment incurved.

F. Oscinides.

PLATYCEPHALA *Fall.* Tetanocera *Latr.* 2 sp. *M. planifrons* F.
Head nearly triangular, broader than the body; forehead concave; antennæ elongate, second joint obliquely truncate, third compressed, pointed; hind femora rather thickened. Curt. 725.

EURHINA *Meig.* ——— 1 sp. *E. lurida.* Meig. pl. 55. f. 12.
Head elongate, triangular; palpi short, cylindric; face short, horizontal; antennæ distant, second joint elongate, third oval; style naked; abdomen depressed.

MEROMYZA *Meig.* Oscinis *Fall.* 5 sp. *M. saltatrix* L.
Hind thighs thick; tibiæ curved; marginal and submarginal nerves curved, transverse nerves contiguous; antennæ porrected, third joint obovate; style naked.

CHLOROPS *Meig.* Tephritis *Fab.* 24 sp. *C. Pumilionis* L.
Face naked; forehead tomentose; arista pubescent or naked, distinctly 2-jointed; abdomen oval; feet naked; costal nerve extending to the tip of the submarginal.

S. g. *Oscinis* Latr. Chlorops *Meig.* p. 13 sp. *M. Frit* L.?
Differs from Chlorops in being generally black-coloured, and with the costal nerve extending to the externo-medial; abdomen oval.

S. g. *Siphonella* Mcq. Madiza *Fall.* 1 sp. *S. albipalpis.*
Rather broad; head hemispherical; terminal lips of the proboscis long, slender, and folded back; face short; forehead tomentose; basal joints of antennæ indistinct; legs naked; tibiæ curved.

S. g. *Elachiptera* Mcq. Chlorops p. *Meig.* 1 sp. *C. brevipennis* Meig.
Wings in ♂ short, ♀ rudimental; thighs rather thickened; arista thick; face short; epistoma with two setæ.

CAMAROTA *Meig.* ——— 1 sp. *C. aurifrons* Hal.
Head oval, depressed; marginal nerve united with the mediastinal.

HOMALURA *Meig.* ——— 1 sp. *H. tarsata* Meig.
Antennæ inserted beneath a frontal protuberance; scutellum large; abdomen oval, broad, depressed; transverse nervures contiguous.

G. Piophilides ?.

GYMNOPA *Fall.* Eristalis *Fab.* 2 sp. *G. glabra* Fall.
Rather narrow; terminal lips of the proboscis long, slender, and recurved, setose, pointed in ♀; first joint of antennæ very short, second rather long, third obovate; style naked.

PIOPHILA *Fall.* Tyrophaga *Kirby.* 6 sp. *M. Casei* Linn. Curt. 126.
Face not prominent; mediastinal nervure double; body shining; palpi clavate; abdomen oblong, depressed; third joint of antennæ oval; style naked.

S. g. *Saltella* R. D. Anisophysa *Macq.* 4 sp. *S. nigripes* R. D.
Proboscis thick; palpi very small, terminated by a seta; face carinated; third joint of antennæ long; style naked; scutellum ♀ elongated; legs differing in the sexes.

Obs. Mr. Haliday refers his subgenus *Pandora* (characterised by the dif-

ference in the nervures from Piophila, and the more convex face and thicker legs, *Ent. Mag.* vol. i. p. 169.) to *Saltella* R. D.

H. Sepsides.

(See Mr. Walker's monograph in *Ent. Mag.* vol. i. No. 3. April 1833).

SEPSIS *Fall.* Micropeza *R. D.* 11 sp. *M. cynipsea* Linn.
Abdomen subpetiolate; wings spotted; anterior femora and tibiæ spinose ♂; palpi rudimental. Harris, Exp. pl. 35. f. 43.

S. g. *Enicita* Westw. Enicopus *Wlk.* (g. Coleopt. *Steph.*) 1 sp. *S. annulipes* Meig.
Abdomen subpetiolated; wings not spotted; anterior femora and tibiæ spined in ♂. Curt. 245.

Obs. Mr. Haliday considers Sepsis Leachii (cylindrica *Fall.*) as better placed in this subgenus than in *Themira*.

S. g. *Nemopoda* R. D. Sepsis p. *Fall.* 5 sp. *Cal. cylindrica* Fab.
Abdomen subpetiolate; wings not spotted; legs simple in both sexes.

S. g. *Themira* R. D. Cheligaster *Macq.* 5 sp. *M. putris* var. α Linn.
Abdomen sessile; palpi filiform; wings not spotted.

I. Neriades.

CALOBATA *Meig.* Musca p. *Linn.* 5 sp. *M. petronella* L. Pz. 54. 20.
Head spherical; proboscis exserted; oviduct broad.

MICROPEZA *Meig.* Calobata p. *Fab.* 2 sp. *M. corrigiolata* L.
Head elongate, cuneiform; proboscis not exserted; oviduct linear. Meig. pl. 53. f. 6.

TETANURA *Fall.* ——— 1 sp. *T. pallidiventris* Fall.
Abdomen clavate; face carinated; forehead setose; third joint of antennæ elliptic, compressed; style villose central; wings large; legs rather long.

K. Ortalides.

PLATYSTOMA *Meig.* Dictya *Fab.* 1 sp. *D. Seminationis* Fab. Curt. 505.
Proboscis very thick; palpi large; epistome prominent, third joint of antennæ oblong; style naked; abdomen oval; ovipositor not protruded.

TEPHRITIS *Latr.* Aciphoræ *R. D.* 50 Br. sp.
See Mr. Walker's monograph, in the *Entomol. Mag.* vol. iii. (No. 11. April 1835).

S. g. *Acinia* Macq. Trypeta p. *Meig.* — sp. *T. Leontodontis.* Pz. 20. 23.
Proboscis with thick lips; epistome not prominent; antennæ short, third joint twice as long as the second; wings reticulated; ovipositor depressed, broad.

Obs. The subgenera *Noeeta* R. D. (T. guttularis *M.*) and *Urellia* R. D. (T. radiata *Fab.* Pz. 103. 21.) are referred to this subgenus by Haliday.

S. g. *Terellia* R. D. Tephritis p. *Latr.* — sp. *T. serratulæ* Linn.
Wings not spotted; transverse nerves perpendicular; palpi exposed, thickened at tip; antennæ short, third joint twice as long as second; ovipositor long, depressed.

S. g. *Anomœia* Wlk. Tephritis p. *Latr.* 1 sp. *T. Gaedii* Meig.
Third joint of antennæ long, cylindric; lower transverse nervure longer and more oblique; ovipositor very short; abdomen short, broad.

S. g. *Tephritis* Latr. Trypeta *Meig.* — sp. *T. Arctii.* Pz. 103. 22.
Proboscis with the lips thick; epistome not prominent; third joint of antennæ thrice as long as second; ovipositor depressed, broad; wings banded.

Obs. The subgenera *Forellia* R. D. (T. Arnicæ *Linn.* Pz. 98. 22.), *Acidia* R. D. (T. cognata and two other species), *Tephritis* R. D. (T. Arctii, &c.), *Orellia* R. D. (T. Wiedemanni), and *Sitarea* are referred to this subgenus by Haliday.

S. g. *Urophora* R. D. Tephritis p. *Latr.* — sp. *M. Cardui* Linn.
Proboscis with the lips thick; epistome not prominent; ovipositor convex, elongated, villose; third joint of antennæ thrice as long as the second. Réaum. 3. pl. 45. f. 12—16.

Obs. The subgenera *Aciura* R. D. (M. Lychnidis *Fab., &c.*) *Euleia* (M. Onopordinis *Fab.*), and *Urophora* (M. Cardui, &c.), are referred to this subgenus by Haliday.

S. g. *Ensina* R. D. Myopites *De Brebiss.* — sp. *T. Sonchi* Fall.
Proboscis long, slender, with two elbows; palpi elongated; epistome prominent; third joint of antennæ twice the length of second; ovipositor depressed, short, broad.

Obs. The subgenera *Sphenella* (T. marginata *Fall.*), *Oxyphora* R. D. (T. Westermanni *Meig.*), *Oxyna* R. D. (T. parietina *Linn.*), *Stylia* R. D. (T. Absinthii, &c.), and *Ensina* R. D. (T. Sonchi), are referred to this subgenus by Haliday.

ORTALIS *Fall.* { Myodina, &c. *R. D.* / Sciomyza *Kirby* } — ? sp. *O. vibrans* Fall. Donov. pl. 467. f. 1.
Oral prominence small; epistome not prominent; antennæ not reaching the epistome, third joint oval, compressed, thrice as long as the second.

S. g. *Ceroxys* Macq. Ortalis p. *Fall.* —? sp. *O. Urticæ* Linn. Curt. 649.
Face perpendicular; third joint of antennæ concave above, rounded below, and pointed at tip; arista setose.

Obs. O. Urticæ belongs to the subgenus *Meckelia* R. D., and O. crassipennis *Meig.* to *Melieria* R. D.

S. g. *Herina* Macq. Ortalis p. *Fall.* 1 sp. *H. afflicta* Meig. Curt. 649.
Face mostly very convex; forehead slightly widened; third joint of antennæ prismatic, elongate, four times as long as second, reaching the epistome.

Obs. O. Cerasi, &c. are considered by Haliday as a separate unnamed subgenus, and O. Syngenesiæ belongs to the subgenus *Rivellia* R. D.

ULIDIA* *Meig.* Chrysomyza *Fall.* 2 sp. *T. demandata* Fab. Meig. pl. 53. f. 12.
Head wider than the thorax; palpi dilated; epistome prominent, naked; third joint of antennæ oblong; legs naked.

S. g. *Timia* Meig. Ulidia p. *Macq.* 1 sp. *T. basalis* Curt. Guide.
Differs from Ulidia in having the third joint of the antennæ oval and the wings spotted.

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* Mr. Haliday considers that this genus should be restored to the group Orta lides.

L. Sapromyzides.

LONCHŒA *Fall.* Musca *Fab.* 8 sp. *M. chorœa* Fab. Meig. t. 47. f. 31.
Margin of the mouth setose; forehead narrow in ♂; third joint of antennæ oblong; style naked; ovipositor ♀ exserted.

PALLOPTERA* *Fall.* { Sapromyza *Meig.* / Suillia *R. D.* } 5 sp. *S. umbellatarum* M.
Head sub-hemispherical; epistome not prominent, naked; antennæ short, third joint oblong, compressed, obtuse at tip; style villose, or tomentose; wings vibratile, spotted.

S. g. *Sylvia* R. D. Sapromyza p. *Macq.* 1 sp. *S. obsoleta* Fall. *Tephr. flava* Fab.
Differs from Sapromyza in the yellow colour of body, tomentose style of antennæ, third joint of antennæ elongate, and obliquely truncate beneath.

S. g. *Lycia* R. D. (and *Terenia* R. D.) —? *P. rorida* Fall.
Differs from Sylvia in the third joint of the antennæ obtuse, and the wings not spotted.

S. g. *Peplomyza* Hal. (*Ent. M.* iv. 148.) Phyllomyza *E.M.* vol. i. 1 sp. *S. litura* Hgg.
Thorax as long as the abdomen, the latter oval; legs short; wings with black lines, deflexed at the sides of the body. Curt. 605.

S. g. *Minettia* R. D. Sapromyza A A. *Macq.* 3 sp. *S. rivosa* Meig.
Body generally obscurely coloured; style of antennæ plumose.

S. g. *Toxoneura* Macq. ——— 1 sp. *T. fasciata* Macq.
Head nearly hemispherical; face carinated, a distinct upper lip extending beyond the epistome, and rounded; third joint of antennæ oval; style shortly villose, transverse; nerves curved.

LAUXANIA† *Latr.* Musca p. *Fab.* 1 sp. *L. cylindricornis* Latr.
Palpi rather thickened; face with a transverse impression; forehead setose, third joint of antennæ long; style villose; eyes generally with purple lines.

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* "All late authors have overlooked the strong characters which separate Palloptera *Fall.* from this genus.

Sapromyza Fall.	*Palloptera* Fall.
Tibiæ cilio præapicali.	Tibiæ absque cilio præapicali.
♀ Abdomen ovatum, terebræ valvulis parvis liberis obtusis pubescentibus subexertis.	♀ Abdomen apice attenuatum et depressum, terebra exerta subulata, valvulis cohærentibus glabris.
	Spp. Umbellatarum, ustulata, unicolor = saltuum *L.*, arcuata, 3-macula.

"*Toxoneura* Macq. differs from *Palloptera* by the sinuate præ-brachial nerve. It is founded on *Musca pulchella* of Rossi. The *Ortalis* (or Otites) *pulchella* of later authors is a different species.

"It is not so easy to show any strong character of separation between Palloptera and Lonchæa.

Palloptera.	Lonchœa.
Colour yellow or cinereous.	Black.
Wings spotted.	Wings immaculate."
	Haliday MSS.

† "Lauxania should probably comprise only the species which have the first joint longer than second of antennæ (L. cylindricornis); the others come too near to Sapromyza, and consequently the Minettiæ of R. D. are placed partly in the former, partly in the latter genus by Meigen.

S. g. *Calliope* Hal. MSS. Lauxania *M.* 1 sp. *L. scutellata* Meig. See note below.

OCHTHEPHILA *Fab.* { CHAMÆMYIA *Pz.* / ESTELIA *R. D.* } 3 sp. *O. aridella* Fall.

Oral orifice small, round; face flat, naked; third joint of antennæ oblong, obtusely pointed at tip; style naked; abdomen oblong; mediastinal nerve double.

M. PHYTOMYZIDES.

MILICHIA *Meig.* ARGYRITES *Latr.* 1 sp. *M. speciosa* M.

Abdomen broad, oval, depressed, 4-jointed, silvery in ♂; head depressed; forehead setose; antennæ inserted beneath a frontal prominence.

LEUCOPIS *Meig.* ANTHOMYZA *Fall.* 4 sp. *L. puncticornis*? Meig.

Palpi dilated; face and forehead naked; antennæ porrected; body whitish; abdomen depressed, oval, spotted with black.

AGROMYZA *Fall.* CHLOROPS *Fall.* 24 sp. *A. nigripes* Meig.

Oral aperture small; face and forehead setose; antennæ deflexed; style naked or pubescent; abdomen oblong; mediastinal nerve double at base.

S. g. *Phyllomyza* Fall. Agromyza p. *Meig.* —? sp. *P. securicornis* Fall.

Oral aperture small; palpi exposed, subclavate; third joint of antennæ broad, square, depressed ♂, large and patelliform ♀; style of antennæ villose.

S. g. *Odontocera* Macq. Chlorops p. *Pz.* 1 sp. *O. denticornis.* Pz. 104. 22.

Antennæ with the third joint furnished with a point on the upper side; style naked; mediastinal nervure short.

"The groups of Desvoidy may be thus distinguished: —

"Antennæ with third joint oblong or ovate; disco-recurrent nerve near margin of wing; mediastinal nerve free.

Third joint above impressed - - - - - *Sylvia.*
S. pallidiventris.
———— not impressed.
Arista feathered - - - - - - *Minettia.*
longipennis = luctuosa *R. D.*; fasciata *Fall.* = rivosa *M.* = nemorosa *R. D.*; testacea *R. D.*; flavipes *R. D.*; lupulina *F.*
pallida *M.*; ? inusta *M.*; grisea *M.* = palustris *R. D.*
Arista pubescent.
Front with an impressed line above antennæ. ————?
(*Calliope* A. H. H. preoccupied in Ornithology.) Laux. ænea—scutellata, &c.
Front convex.
Wings incumbent - - - *Lycia* R. D. and *Terenia* R. D.
S. 10-punctata; præusta; interstincta; rorida; 4-punctata, &c. &c.
Wings deflected - - - - *Peplomyza* A. H. H.
S. litura.

"Antennæ with third joint orbicular; disco-recurrent nerve remote from margin; valves of ovipositor concealed (allied to Heteroneura?); no præapical bristle on tibiæ.

Eyes orbicular - - - *Scyphella* R. D.; *Lisella* R. D.
1. flava *L.*; 2. lutea; 3. femorella *Fall.*
Eyes transversely oval - - - - *Chiromyza* R. D.
1. fenestrarum *R. D.*

"The character by which Robineau Desvoidy distinguishes *Scyphella* is accidental. The eggs are remarkably large in this insect, about 60 in number, shaped like a hen's egg, and reticulated, except at the small end, which is smooth, and bounded by a raised ring. When a specimen with fully developed ovaries is dried, the skin sinking in the intervals between the eggs, the abdomen becomes covered with small depressions, 'petits renfoncemens sphériques.'" (*Haliday, MSS.*)

S. g. *Leiomyza* Macq. Agromyza *Meig.* 6 sp. *L. scatophagina.*
Body polished; abdomen elongate; face and forehead naked; mediastinal nerve short; transverse nerves close together.

PHYTOMYZA *Fall.* ——— 19 sp. *P. lateralis* Fall. Curt. 393.
Oral aperture small; antennæ porrected; third joint subovate; first transverse nervure close to the base of the wing, second obsolete.

S. g. *Napomyza A. H. H. MSS.* ——— 1 sp. *P. festiva.*

ASTEIA *Meig.* ——— 2 sp. *A. amœna* Meig.
Head rather broad; basal joint of antennæ minute, third joint broad; arista setose above and below; basal transverse nerve close to the base of the wing, second obsolete.

N. Geomyzides.

SAPROMYZA *Fall.* Scyphella *R. D.* 3 sp. *M. flava* L.
Yellow-coloured; antennæ short, third joint rounded; arista naked; abdomen with spherical impressions.

S. g. *Chiromyza* R. D. ——— 1 sp. *fenestrarum* R. D.
Yellow-coloured; arista naked; epistome not prominent; fore thighs rather large.

HETERONEURA *Fall.* ——— 3 sp. *H. albimana* Meig. Curt. 721.
Basal joint of antennæ minute, second nearly square, as long as third; arista long, inserted in the middle of the third joint; two transverse nerves close together.

S. g. *Clusia* A. H. H. Heteromyza p. *Meig.* 1 sp. *H. flava* M.
" Tibiæ cilio præapicali nullo; alarum nervi transversi, subremoti." *Hal.* (Heter. spurca *Hal.* olim).

OPOMYZA *Fall.* Tephritis p. *Fab.* 2 sp. *M. germinationis* L.
Antennæ deflexed, third joint oval; style finely villose; abdomen elongate, 6-jointed; first transverse nerve medial, second subapical.

S. g. *Geomyza* Fall. Opomyza p. *Macq.* 5 sp. *T. combinata* Fab.
Clypeus impressed, bearded; antennæ short, deflexed; arista subplumose; body oblong; head rounded.

S. g. *Leptomyza* Macq. Anthomyza *Fall.* 4 sp. *A. gracilis* Fall.
Slender; antennæ lenticular; style naked; abdomen filiform, with six distinct segments; fore thighs rather thickened.

S. g. *Tethina* A. H. H. ——— 1 sp. *T. illota* Hal.
" Facies impressa; epistomate prominulo nullo; labium bigeniculatum; antennæ brevissimæ, articulo tertio suborbiculato; arista gracili, subnuda." (*Hal.*)

AULACIGASTER *Macq.* ——— 1 sp. *A. rufitarsis* Macq.
Head hemispheric; face with a transverse line; arista naked; mediastinal nervure short, doubled at the tip; abdomen with impressed transverse lines.

DIASTATA *Meig.* Geomyza *Fall.* 4 sp. *D. obscurella* Meig. pl. 59. f. 14.
Face flat; epistome setose; third joint of antennæ long, obtuse; style plumose; transverse nerves wide apart.

DROSOPHILA *Fall.* Musca *Linn.* 14 sp. *M. cellaris* L. Curt. 473.
Third joint of antennæ oval; style plumose; palpi long, subclavate; transverse nerves wide apart; thorax elevated; colour testaceous.

S. g. *Camilla* A. H. H. ——— 1 sp. *C. glabra* Hal.
" Tibiæ cilio præapicali nullo; antennæ decumbentes, facie breviores, articulo tertio oblongo; arista pectinata; labium incrassatum." (*Hal.*)

STEGANA *Meig.* Drosophila p. *Fall.* 1 sp. *annulata* Hal. Meig. pl. 58. f. 22.
Head hemispherical, depressed; palpi very thick; wings curved, marginal nerve nearly reaching the apex; first transverse nerve near the base of the wings.

O. Hydromyzides.

(See Mr. Haliday's monograph in *Ann. Nat. Hist.* June and August, 1839).

TEICHOMYZA *Mcq.* Ephydra p. *Mcq.* vol. vii. 1 sp. *T. fusca* Mcq. (R. longipennis *Mg.*)
Head longer than broad; face very prominent, as far advanced as the rest of the head, setose on each side; style of antennæ naked; abdomen elongate, 6-jointed.

OCHTHERA *Latr.* Tephritis *Fab.* 1 sp. *O. Mantis* Latr.
Fore femora greatly thickened; coxæ elongate. My Ent. T. B. pl. 3. f. 7.

NOTIPHILA *Fall.* Keratocera *R. D.* 3 sp. *N. cinerea* Fall.
Legs subequal; eyes glabrous; second joint of antennæ unguiculated; costal nerve terminating at the apex of the wing; abdomen ♂ unarmed.

S. g. *Dichaeta* Meig. Notiphila *Fall.* 1 sp. *D. caudata* Fall.
Differs from Notiphila in having the ♂ abdomen spinose.

S. g. *Discomyza* Meig. Psilopa *Fall.* 1 sp. *D. incurva.* Meig. pl. 58. f. 14.
Differs from Notiphila in having the costal nerve carried round the apex of the wing, and the wings deflexed posteriorly.

S g. *Trimerina* Mcq. Psilopa *Fall.* 1 sp. *P. madizans* Fall.
Abdomen apparently 3-jointed; proboscis unigeniculate; wings flat.

S. g. *Hygrella* Hal. Psilopa *Fall.* 2 sp. *P. nitidula* Fall.
Third joint of antennæ oblong; abdomen 5-jointed; wings flat.

S. g. *Discocerina* Mcq. Notiphila *Meig.* 4 sp. *P. calceata* Fall.
Antennæ with the third joint suborbicular; abdomen 5-jointed; proboscis 1-geniculate.

S. g. *Hecamede* Hal. ——— 1 sp. *N. albicans* Meig.
Proboscis bigeniculate; wings flat; costal nerve running round the apex of the wing.

HYDRELLIA *R. D.* Notiphila *Fall.* 15 sp. *H. flaviceps* Meig.
Legs subequal; eyes pilose or velvety; antennæ with the second joint exunguiculate; wings exunguiculate.

S. g. *Hydrellia* R. D. Arista pectinated above; face convex. 13 sp. *N. flaviceps* Meig.

S. g. *Atissa* Hal. Arista pectinated above; face impressed. 1 sp. *A. pygmæa* Hal.

S. g. *Glenanthe* Hal. Arista finely pubescent. 1 sp. *G. ripicola* Hal.

EPHYDRA *Meig.* Notiphila *Fall.* 35 sp. *E. riparia* Fall. Curtis, 413.
Legs subequal; eyes glabrous; antennæ with the second joint exunguiculate; proboscis incrassate.

The following Subgenera of *Ephydra* are described by Mr. Haliday in his monograph on this group. *Hydrina* Desv. 7 sp. (*Not. punctato-nervosa* Fall.); *Hyadina* Hal. 2 sp. (*E. guttata* Fall.); *Axysta* Hal. 1 sp. (*E. viridula* Desv.); *Pelina* Hal. 1 sp. (*N. ænea* Fall.); *Napæa* R. D. 5 sp. (*E. coarctata* Fall.); *Ilythea* Hal. 1 sp. (*E. spilota* Hal. Curtis, 413.); *Cænia* R. D. 3 sp. (*E. palustris* Fall.); *Scatella* Desv. 10 sp. (*E. quadrata* Fall.); *Teichomyza* Mcq. 1 sp. (*T. fusca* Mcq. described above); *Ephydra*, 2 sp. (*E. riparia* Fall.); *Canace* Curt. 1 sp. (*C. Nasica.*)

P. Hypocera *Latr.* Trineuræ *Meig.*

PHORA *Latr.* Trineura *Meig.* 30 sp. *P. incrassata* Meig. Curt. 437.
Third joint of antennæ spherical; margin of wings ciliated.

S. g. *Gymnophora* Mcq. Trineura *Fall.* 1 sp. *P. arcuata* Meig.
Second joint of antennæ spherical; margin of wings not ciliated.

S. g. *Conicera* Meig. ——— 1 sp. *C. atra* M.
Third joint of antennæ conical, elevated vertically.

Family 4. (or 23.) *ŒSTRIDÆ* Leach. (Œstracidæ *Meig.* Astomata *Dum.*)

ŒSTRUS *Auct.* Hypoderma *Latr.* 2 sp. *Œ. Bovis* Fab. Curt. 106. nec Linn.
Nerves not extending to the hind margin of the wing; first discoidal cell extending to the front apex of the wing.

CEPHALEMYIA *Latr.* Œstrus p. *Clark.* 2 sp. *Œ. Ovis* L.
Differs from Œstrus in the first discoidal cell closed. Meig. t. 38. f. 16.

GASTEROPHILUS *Leach.* { Gastrus *Meig.* / Œstrus *Latr., Mcq.* } 4 sp. *Œ. Equi* Fab.
Nerves extending to the hind margin of the wing. Curt. 146.

Sect. II. (or Stirps 5.) Thoracocephala *Westw.* (Pupipara *Latr.* Order *Homaloptera* MacL. *Omaloptera* Leach.)

Family 1. (or 24.) *HIPPOBOSCIDÆ* Leach. (Coriaceæ *Meig.*)

HIPPOBOSCA *L.* Nirmomyia *Nitzsch.* 1 sp. *H. equina* L. Curt. 421.
Wings full-sized; nervures not extending to the apex.

ORNITHOMYIA *Olf., Latr.* Hippobosca p. *L.* 4 sp. *H. avicularia* L.
Wings full-sized; nerves distinct, extending to the apex; antennæ ciliated. Curt. 585.

HÆMOBORA *Curt.* Ornithobia *Meig.*? 1 sp. *H. pallipes.* Curt. 14.
Wings full-sized; nervures distinct (fewer than in Ornithomyia), extending to the apex; antennæ not ciliated.

CRATERINA *Olfers.* Stenepteryx *Leach.* 1 sp. *H. Hirundinis* L. Curt. 122.
Wings long, very narrow, and accuminated (*fig.* 133. 13.)

OXYPTERUM *Kirby.* Anapera *Meig.* 2 sp. *O. Kirbyanum* Leach.
Wings short, triangular. K. & S. pl. 5. f. 1.

MELOPHAGUS *Latr.* Melophila *Nitzsch.* 1 sp. *H. ovina* L. Curt. 142.
Apterous. My fig. 133. 11.

Family 2. (or 25.) *NYCTERIBIIDÆ* Westw. (Nycteribidæ *Leach.*)

NYCTERIBIA *Latr.* { Celeripes *Mont.* / Phthiridium *Olf.* } 1 sp. *N. Latreillii* Leach.
Apterous; abdomen ♀ simple. Curt. 277., and my fig. 133. 15.

S. g. *Stylidia* Westw. Nycteribia p. *Mont.* 1 sp. *N. biarticulata* Herm.
Differs in the abdomen of ♀ being furnished with two long styles (my fig. 133. 23.)

ADDENDA

TO THE GENERIC SYNOPSIS OF BRITISH INSECTS.

Page 3. line 23. for " Pœcillus " read " Pœcilus."
5. line 17. for " Æpus " read " Aëpus."
6. line 24. for " Alphæus " read " Alpæus."
line 47. " Ocys 3 sp."

12. STRONGYLUS ——— 2 sp. type *S. ferruginea* Fab. Pz. 84. 2.
CRYPTARCHUS *Shk.* STRONGYLUS p. *Ste., &c.* 2 sp. *N. strigata* F. Curt. 339.
Differs from Strongylus in the antennæ being inserted beneath the produced sides of the head, and the club compressed.
ANOMÆOCERA *Spry & Shk.* p. 25., is identical with Anisocerus *Howitt.*
IPS ——— 4 sp. type *S. 4-pustulata.*
PITYOPHAGUS *Shk.* IPS p. *Curtis, &c.* 1 sp. *D. ferruginea* L.
Differs from Ips in the elongate sub-cylindrical form of the body as well as in the trophi. Pz. 8. 15.

13. After " COLYDIUM," add
TEREDUS *Dej. Cat.* LYCTUS p. *Fab.* 1 sp. *L. nitidus* F.
Linear-cylindric; antennæ 11-jointed; club 2-jointed, obtuse; thorax convex-cylindric, elongate, entire; tarsi 4-jointed. Spry & Shk. pl. 34. f. 6.
Before " CICONES," add
SYNCHITA *Hellw.* LYCTUS p. *Fab.* 1 sp. *L. Juglandis* Fab.
Oblong, sub-depressed; club acute at tip; thorax with elevated margins. Pz. 5. 17.
Mr. Shuckard proposes (*El. Brit. Ent.* p. 173.) the uncharacterised generic name HYDROPHYTOPHAGUS for Cryptophagus Caricis, and C. Typhæ.
CUCUJUS. Retaining the reputed British species C. depressus as the type; C. dermestoides forms the genus PEDIACUS *Shk.* (*El. Brit. Ent.* p. 185.), or the uncharacterised genus BIOPHLÆUS of Dejean's Catalogue, whilst C. piceus, and all the other British species, form the genus LÆMOPHLÆUS. (Laporte *Hist. Nat. An. Art.* 1. 384.)

Page 14. line 22. read " TYPHÆA and PENTAPHYLLUS."
After " Typhæa," add
SPHINDUS *Dej.* ——— 1 sp. *N. dubia* Gyll.
Oblong, ovate, convex; thorax margined; club of antennæ large, heart-shaped, 3-jointed; tarsi 5-jointed, according to Gyllenhall. Spr. and Shk. pl. 53. f. 1.

15. line 4. Eutheia scydmœnoides *Water.* is Scydmœnus abbreviatellus *Erichs.* (Sturm. pl. 264. B.) I possess a second British species of this genus.

Page 16. After " OXYPORUS," add

EURYPORUS *Erichs.* PELECYPHORUS *Nordm.* 1 sp. *S. picipes* Pk.
Antennæ short, filiform, distant at base; maxillary palpi filiform; labial securiform; mandibles acute. Spry and Shk. pl. 20. f. 6.

After " GYROHYPNUS," add

LEPTACINUS *Erichs.* GYROHYPNUS p. *Ste.* 4 sp. *S. Batychrus* Kn.
Antennæ elbowed, approximating, terminal joint acute; palpi with last joint subulate; head moderate; elytra flattish; suture imbricated; fore tarsi simple.

17. MEDON *Steph.* is LITHOCHARIS *Erichs.* (2 Br. sp.)

After " HESPEROPHILUS," add

PHYTOSUS *Rudd.* ——— 1 sp. *P. spinifer* Rudd. Curt. 718.
Elongate, sub-convex; antennæ elbowed, two basal joints equal; thorax flattish, not channeled; fore tarsi 4-, posterior 5-jointed.

18. After " ANTHOBIUM," (11 Brit. sp.) add

DELIPHRUM *Erichs.* ANTHOBIUM p. *St.* 1 sp. *St. tectus* Pk.
Mandibles simple; maxillæ with membranous lobes, the outer dilated; last joint of maxillary palpi longer than the preceding; tibiæ spinulose. Oliv. 42. pl. 3. f. 21.

LATHRIMÆUM *Erichs.* ANTHOBIUM p. *St.* 6 sp. *Om. atrocephalum* Gyll.
Mandibles entire; last joint of palpi longer than the preceding; tibiæ not spinulose.

OLOPHRUM *Erichs.* ANTHOBIUM p. *St.* 4 sp. *Om. piceum* Gyll.
Mandibles entire; maxillæ with elongate corneous lobes; last joint of palpi twice as long as the preceding; tibiæ simple.

After " ACIDOTA," add

DELEASTER *Erichs.* LESTEVA p. *Curt.* 1 sp. *S. dichroa* Grav.
Differs from Lesteva in wanting ocelli and maxillary palpi subacuminate at the tip. Curt. 303.

19. After " TACHYPORUS," add

HABROCERUS *Erichs.* TACHYPORUS b. *St.* 1 sp. *T. nodicornis* K.
Differs from Tachyporus in having the antennæ nodose and clothed with verticillate hairs.

19. After " ISCHNOPODA," add

TACHYUSA *Erichs.* ——— 2 sp. *Aleoch. atra* Grav.
Head exserted; thorax subquadrate or ovate; abdomen rather broad; legs moderate; anterior tarsi 4-, posterior 5-jointed, basal joint slender. Spry and Shk. pl. 24. f. 2.

OCALEA *Erichs.* ALEOCHARA p. *St.* 1 sp. *A. picata* K.
Elongate; head exserted; thorax rounded behind, anterior angles acute; abdomen linear; legs long, slender; tarsi 5-jointed. Spry and Shk. pl 24. f. 4.

After " GYMNUSA," add

SILUSA *Erichs.* ——— 1 sp. *S. rubiginosa* Er.
Head sessile; thorax short; elytra transverse; anterior tarsi 4-, posterior 5-jointed, joints equal; labial palpi exarticulate.

20. After " ALEOCHARA," add

CERANOTA *St.* ALEOCHARA p. *St.* olim. 1 sp. *A. Daltoni* St.

Page 20. Head small, subsessile; thorax convex, broad, rounded; elytra very short; four basal segments of abdomen ♂ tubercled on the back; tarsi 5-jointed.

LOMECHUSA emarginata *Grav.* is "not truly indigenous," *Steph.*

21. After "PSELAPHUS," add

CLAVIGER *Preysl.* ——— 1 sp. *C. foveolatus* Mull.

Tarsi with one unguis; eyes wanting; antennæ 6-jointed. (See Vol. I. p. 176. note*, and App. to Vol. I.) My fig. 17. 6.

22. After "DENDROPHILUS," add

EPIERUS *Erichs.* (*Jahrb.*) DENDROPHILUS p. *St.* 1 sp. *D. 14-striatus* St. Spry and Shk. pl. 41. f. 3.

Oval, flattish; mandibles not prominent; prosternum truncate behind; anterior tibiæ serrated with spines; 4 posterior rounded with a row of scattered spines.

TERETRIUS *Erichs.* HISTER p. *Fab.* 1 sp. *H. picipes* Fab.

Elongate, flat; mandibles not exserted; prosternum rounded behind; elytra not striated; tibiæ broad, compressed, toothed. Spry and Shk. pl. 41. f. 6.

line 24. for "ORTHOPHILUS" read "ONTHOPHILUS."

23. line 40. for "*solstitialus*" read "*solstitialis.*"

26. Stephens gives Hypolithus and Cryptohypnus as distinct in his Manual.

28. Ptinus imperialis belongs to Latreille's subgenus *Hedobia.* (See Vol. I. p. 271.)

30. After "SCYDMÆNUS," add

MEGALADERUS *Ste.* { TYTTOSOMA *Wesm.* / MICRODEMA *Lap.* } 1 sp. *S. thoracicus* Kirby.

Denny, pl. 11. f. 3. (Vide Vol. I. p. 281.)

Laporte also separates S. tarsatus, ruficornis, and Hellwigii under the name of Eumicrus.

35. line 36. for "Elytra rostrated" read "Elytra costated."

37. After "TYCHIUS," add

MICCOTROGUS *Sch.* TYCHIUS B. *St.* 2 sp. *H. picirostris* Fab.

Differs from Tychius in the funiculus being 6- and not 7-jointed; rostrum filiform; body slender, sub-squamose; thighs and tibiæ unarmed.

39. After "TOMICUS," add

(HYPOTHENEMUS *Westw.* in *Trans. Ent. Soc.* 1. pl. 7. f. 4. 1 sp. *H. eruditus* Westw. See Vol. I. p. 353.

Antennæ with the second joint large, third and fourth very minute, remainder forming a thick club; elytra rounded behind.)

40. Serville has divided the genus CALLIDIUM into two sections, the second consisting of the typical species C. Bajulus, for which he therefore inappropriately suggests the name of Hylotrupes. (*Ann. Soc. Ent. Fr.* 1834. p. 77.), adopted by Stephens and Shuckard.

42. 43. The genera HALTICA, CHRYSOMELA, PHÆDON, and COCCINELLA, have been greatly cut up by Chevrolat into uncharacterised subgenera in Dejean's Catalogue, and which have been partially adopted as divisions by Mr. Stephens.

Page 43. After "TRIPLAX," add

ECANUS *Rudd. MSS., Steph.* 1 sp. *T. glaber* Pk.

Sub-hemispheric; antennæ with an elongate, 3-jointed, acute club.

47. After "LACHESILLA," add

CLOTHILLA *Westw.* ——— 1 sp. *C. studiosa* Westw.

Antennæ long, more than 25-jointed; tarsi 3-jointed; wings obsolete.

Obs. Atropos and Lachesilla form the genus Troctes *Burm.*

OXYCYPHA *Burm.* is synonymous with Brachycercus and Cœnis.

A mark of doubt should be added to the name E. bioculata *Linn.* (?), and E. venosa *Fab.* given as the type of Baetis.

Ephemera horaria *Linn.* is the second species of Burmeister's genus PALINGENIA. Stephens gives this species as British, but with a doubt as to the name. The type of this genus is the E. Swammerdamiana.

47. After "CLOEON," add

BRACHYPHLEBIA *Westw.* Vol. II. p. 25. note*. *Cloe* B. Burm.

Two caudal setæ, four wings; posterior very minute, with only two longitudinal nerves; front margin angulated.

Obs. I cannot cite E. halterata of Fabricius as the type of this genus, as he expressly says that that species has three anal setæ.

48. After "HEMEROBIUS," add

SISYRA *Burm.* HEMEROBIUS *C. Steph.* 3 sp. *H. fuscatus* Fab.

Anterior wings with the costal nervures simple, few in number; discoidal nervures not arising from the longitudinal rib, but parallel thereto. St. pl. 30. f. 4.

79. After "Sect. II." add

Subsection 1. *Prædones.* Vide Vol. II. p. 184.

Division 1. *Insectivora.*

84. After "ANDRENA," add

MEGILLA *Fab.* ANDRENA p. *Latr.* 1 sp. *M. labiata* F. Dufour in *Ann. Soc. Ent. Fr.* 7. pl. 9. f. 3.

Two submarginal cells; spur of fore legs simple; ocelli in a straight line.

END OF THE GENERIC SYNOPSIS.

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